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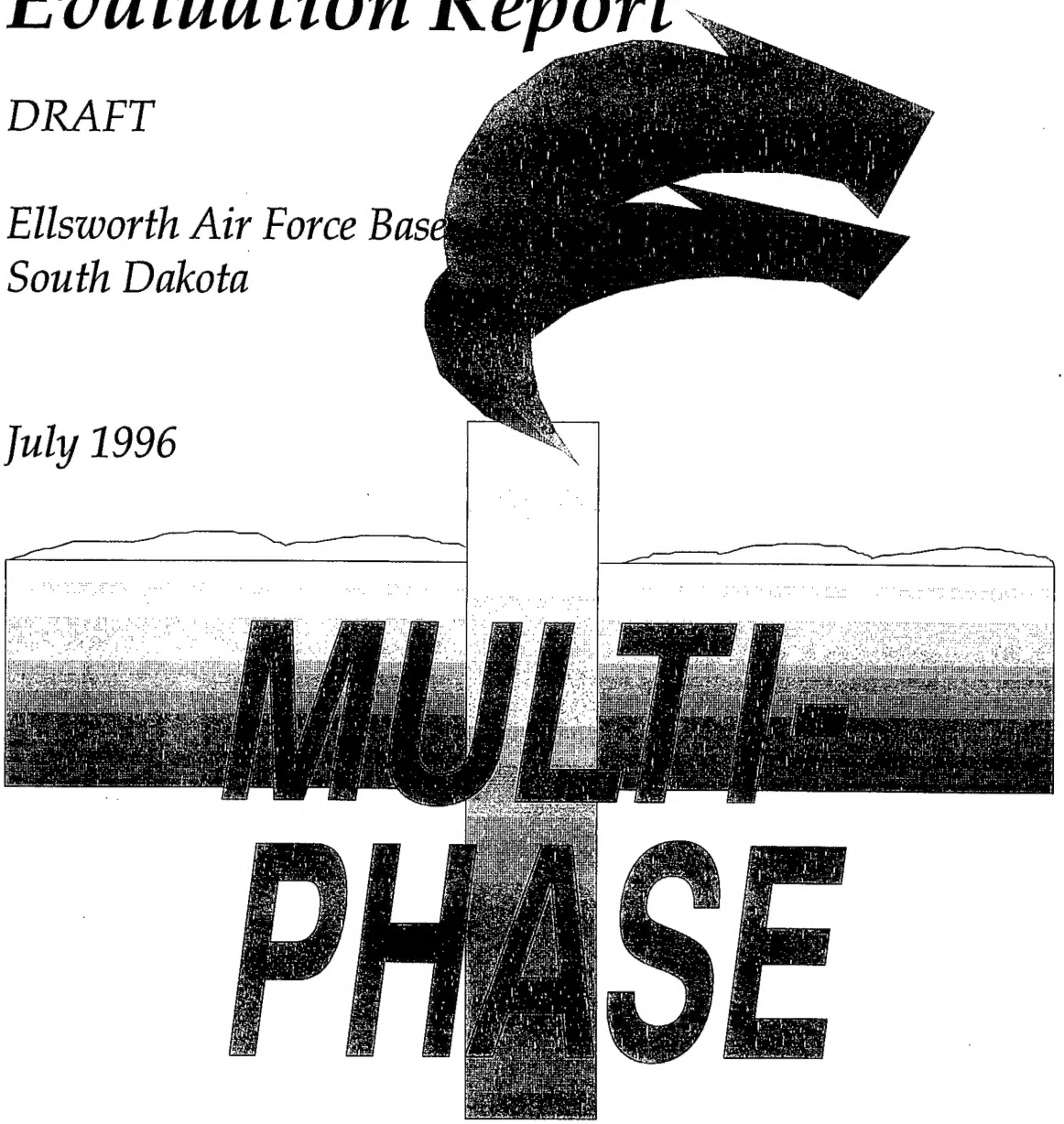
Ellsworth AFB BG-04 Site

Multi-Phase Pilot Test Technology Evaluation Report

DRAFT

Ellsworth Air Force Base
South Dakota

July 1996



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(916) 362-5332
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26 July 1996

U.S. Army Corps of Engineers, Omaha District
ATTN: CEMRO-ED-EB (Robert Zaruba)
215 North 17th Street
Omaha, Nebraska 68102-4978

SUBJECT: Contract No. DACA45-93-D-0027, Delivery Order No. 27, Mods 04 and 05; Draft Ellsworth AFB Multi-Phase Pilot Test Technology Evaluation Report, BG-04 Site

Dear Mr. Zaruba:

Enclosed are seven (7) copies of the draft Ellsworth AFB Multi Phase Pilot Test Technical Evaluation Report performed at the BG-04 site per instructions from Ms. Kellie Kachek of the Omaha District. I have forwarded two copies to Ms. Margaret Calvert at ACC CES/ESVW, Langley AFB, six copies to Mr. Dell Petersen at Ellsworth AFB, one copy to Peter Ismert at EPA Region VIII, one copy to Mr. Ron Holm at the State of South Dakota, two copies to Mr. Keith Anderson at RUST, and one copy to Mr. Robert Todd at EA.

If you have any questions regarding this deliverable please contact me at (916) 857-7281 or Mr. Bill BuChans at (423) 483-9870.

Sincerely,

Francis E. Slavich, PE
Program Manager

c: Ms. Margaret Calvert, ACC CES/ESVW, Langley AFB (2)
Mr. Dell Petersen, Ellsworth AFB (6)
Mr. Peter Ismert, US EPA (1)
Mr. Ron Holm, SDDENR (1)
Mr. Keith Anderson, RUST (2)
Mr. Robert Todd, EA (1)
Bill BuChans, Radian (5)
James Machin, Radian (1)
Suzanne Sellers, Radian (1)

ELLSWORTH AFB
MULTI-PHASE PILOT TEST
TECHNOLOGY EVALUATION REPORT
FOR BG-04 SITE

Ellsworth Air Force Base
South Dakota

Prepared for:

U.S. Army Corps of Engineers
Omaha District
ATTN: CEMRO-ED-EB
215 North 17th Street
Omaha, Nebraska 68102

Prepared by:

Radian Corporation
1093 Commerce Park Drive, Suite 100
Oak Ridge, Tennessee 37830
Doc. #960716.1

July 1996

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ACRONYMS

ACC	Air Combat Command
AFB	Air Force Base
BGS	Below Ground Surface
EA	Engineering, Science, and Technology
EP	U.S. Environmental Protection Agency
HQ	Headquarters
HVDPE	High-Vacuum Dual-Phase Extraction
LVDPE	Low-Vacuum Dual Phase Extraction
MCL	Maximum Contaminant Level
MPE	Multi Phase Extraction
MW	Monitoring Well
OU	Operable Unit
PREECA	Presumptive Remedy Engineering Evaluation/Cost Analysis
PVC	Polyvinyl Chloride
RUST	Rust Environmental and Infrastructure
TCE	Trichloroethylene
TPE	Two-Phase Extraction
USAF	U.S. Air Force
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound

1.0 INTRODUCTION

In May 1996, Ellsworth Air Force Base (AFB), in Rapid City, South Dakota, and Radian Corporation (Radian) completed a seven-day pilot treatability test at the BG-04 site of Operable Unit-11 (OU) using Two-Phase Extraction (TPE), one of the Multi Phase Extraction (MPE) technologies. This report provides a summary of the methodology used during the test, the test results, and base-specific recommendations.

1.1 Purpose/Objectives

On 5 May 1995, Headquarters (HQ) Air Combat Command (ACC) published *United States Air Force Presumptive Remedy Engineering Evaluation/Cost Analysis* (PREECA) (U.S. Air Force [USAF], 1995) as a standardized decision framework specifying the criteria and associated decision logic necessary for implementing a nontime-critical removal action for various commonly used technologies. This decision framework, developed by Radian in conjunction with the U.S. Army Corps of Engineers and the USAF, combines the standard Comprehensive Environmental Response, Compensation, and Liability Act (CERLCA) nontime-critical removal action process with the concept of presumptive remedies and a "plug-in" logic tree approach. The result is a "generic" remedy selection document for all USAF installations that facilitates early and substantial risk reduction at USAF sites. **PREECA applies only to a closely defined subset of conditions** that the USAF has found to be common and that pose sufficient risk to justify nontime-critical removal actions. **This methodology was not intended to be used at sites where the need for cleanup actions is not readily apparent.**

In general PREECA focuses on remedies that can satisfy the majority of common USAF contamination situations, namely in situ bioventing, soil vapor extraction, groundwater containment, and capping. **However, PREECA is intended to be updated as new, successful remedies are established.** The USAF is currently gathering extensive cost and performance data at a number of contaminated sites for addition of the multi-phase extraction technologies that include TPE, Low Vacuum Dual-Phase Extraction (LVDPE), and High Vacuum Dual-Phase Extraction (HVDPE). As part of this effort, HQ ACC has contracted with Radian through the Omaha District Corps of Engineers to evaluate the MPE technology for inclusion in the USAF PREECA. Radian, in conjunction with the USAF, developed an initial remedy profile for MPE as part of the PREECA effort.

This report presents the results of the TPE pilot test conducted at Ellsworth AFB in May 1996. It compares the pilot test results to the remedy profile for MPE technologies and demonstrates that TPE is an effective technology for use at Ellsworth AFB. In addition, it presents data on additional objectives for the pilot test, which were to:

- Demonstrate the contaminant removal effectiveness of the TPE technology;
- Determine the feasibility of installing a full-scale system;
- Collect sufficient engineering data to facilitate the design, installation, and operation of a full-scale extraction and treatment system; and
- Assist in the prevention of contaminant migration, thereby minimizing the threat of exposure to human health and the environment.

TPE was selected for testing at the BG-04 site because of the medium to low permeabilities of the soil at this site. The TPE technology is designed to enhance control of groundwater plumes in low- to moderate-permeability formations, as well as to remove contaminants from the saturated and vadose zones. Ellsworth AFB is in the process of implementing a time critical removal action at BG-04 that may consist of groundwater containment and/or

remediation. A large complement of information exists for the BG-04 site including the remedial investigation report [EA Engineering, Science, and Technology (EA), 1995] and the data from two recent studies (Rust Environmental and Infrastructure [RUST], 1995 and 1996).

1.2 Site Background

BG-04 is located in the northeastern portion of Ellsworth AFB as shown in Figure 1-1. This site is north of the housing area, and is in the vicinity of the site staging area used during the construction of the housing area. Previous field activities in the area have included installation and sampling of monitoring wells, water level measurements, aquifer testing, a seismic survey, and a direct push investigation. Data collected from these activities, in addition to data from this project, have been used to characterize the subsurface features and the nature and relative extent of contamination at the site.

1.2.1 Subsurface Features

The BG-04 site is underlain by approximately 18 to 20 feet of soil (alluvium) that overlies weathered shale and shale bedrock of the Pierre Shale Formation (Figure 1-2). The overlying soil consists of interbedded clay, silt, sand and gravel. The clay, silt, and sand units are fine grained and have low to moderate permeabilities based on visual inspection. The gravel units are present at the base of the site soils and represent higher permeability materials. These basal gravels are sometimes present in paleochannels eroded into the bedrock surface in the BG-04 site. Other contractors have postulated that contaminant migration occurs primarily down these paleochannels (RUST, 1995).

The upper portion of the Pierre Shale is weathered and consists of variably fractured light olive gray to dark olive gray clay, which increases in competence with depth. Weathered shale is at least 13 feet thick in the study area (work in the area of the BG-04 plume did not delineate the depth at which competent shale is encountered). The permeability of the weathered and fractured shale is likely to be low.

Extraction well EW-2 was completed primarily within the overlying alluvium and a couple of feet into the weathered shale bedrock and was screened from 13 to 23 feet below ground surface (BGS). Depth to groundwater in the well was 14 feet BGS. The saturated alluvial thickness ranged from 4 to 6 feet in the extraction well and adjacent piezometers (P-1, P-2, and P-3).

Data from slug tests conducted by EA indicate the geometric mean hydraulic conductivity for the shallow aquifer at Ellsworth AFB is 1.1×1.0^{-4} centimeters per second (cm/s). Figure 1-3 shows the distribution of hydraulic conductivities for the saturated zone across the base. These slug tests were conducted on numerous wells in various parts of the Base. Most wells are screened across the entire saturated zone of the shallow aquifer. This aquifer is quite variable across the Base and consists of heterogeneous mixtures of alluvial material (clay, silt, sand, gravel) and/or fractured shale. This results in the rather large spread of hydraulic conductivities as shown in Figure 1-3.

Hydraulic conductivities were measured in the BG-04 test area by a slug test in EW-2 and a recovery test in P-1 and were 1.3×10^{-3} and 2.1×10^{-2} cm/s, respectively. These values, although variable, are consistent with the range of values measured elsewhere on the Base. This variability is indicative of the heterogeneous nature of the deposits at the site.

Groundwater flow direction is generally to the southeast in the BG-04 plume area; however, site-specific data were not yet available in the test area as of the preparation of this report.

1.2.2 Nature and Extent of Contamination

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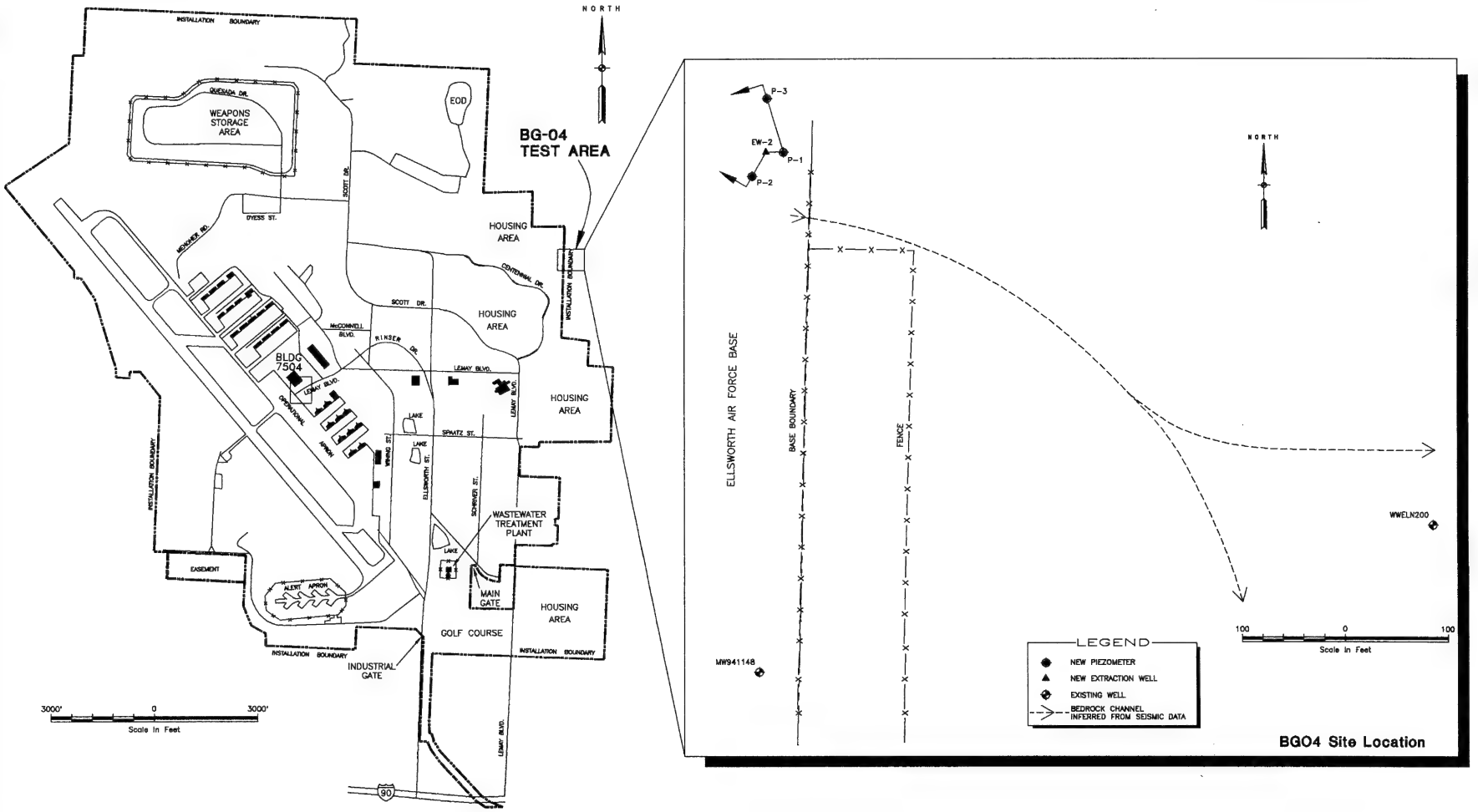

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1093 COMMERCE PARK DRIVE, SUITE 100
OAK RIDGE, TENNESSEE

Figure 1-1. BG-04 Site, Ellsworth AFB

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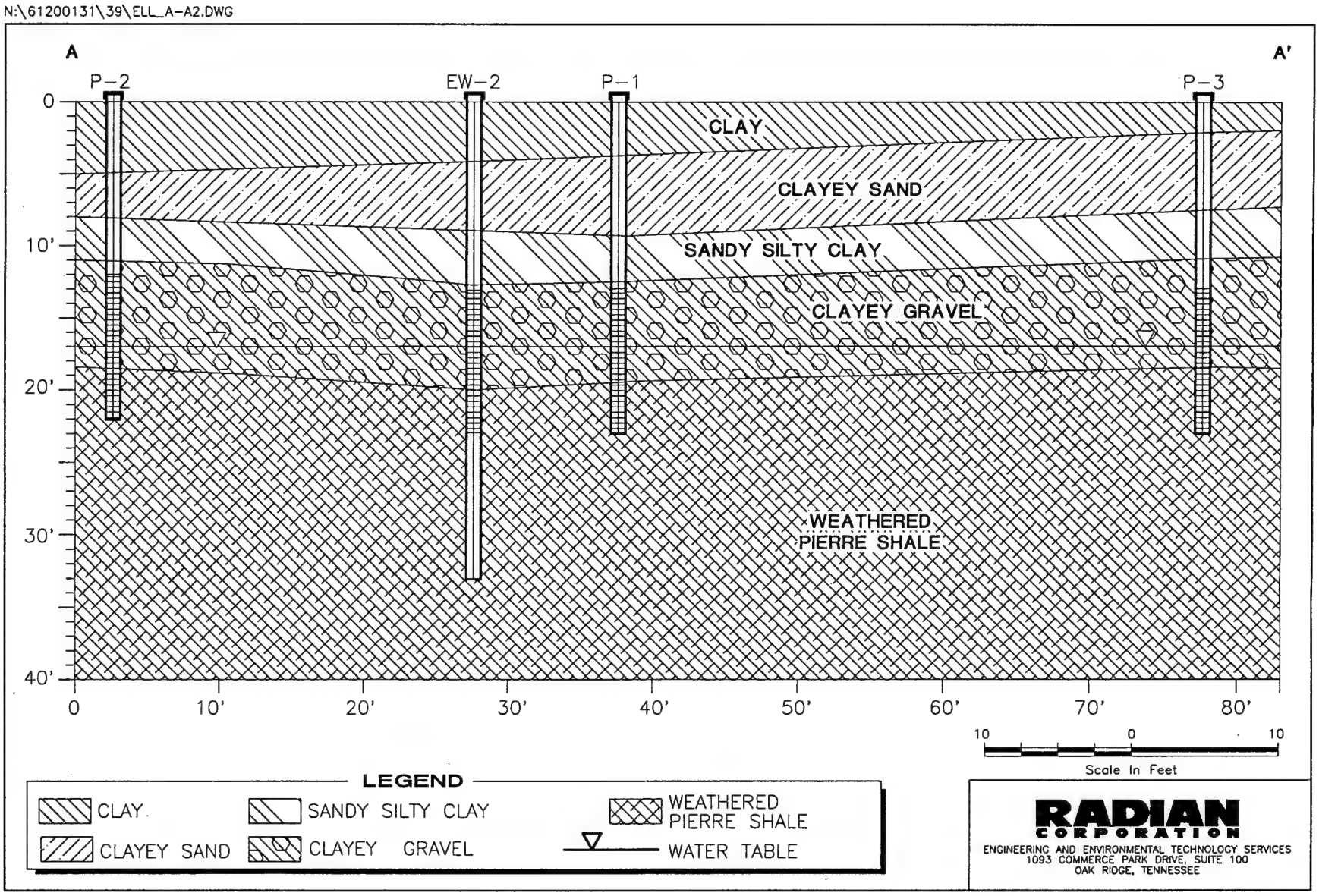


Figure 1-2. BG-04 Conceptual Cross-Section

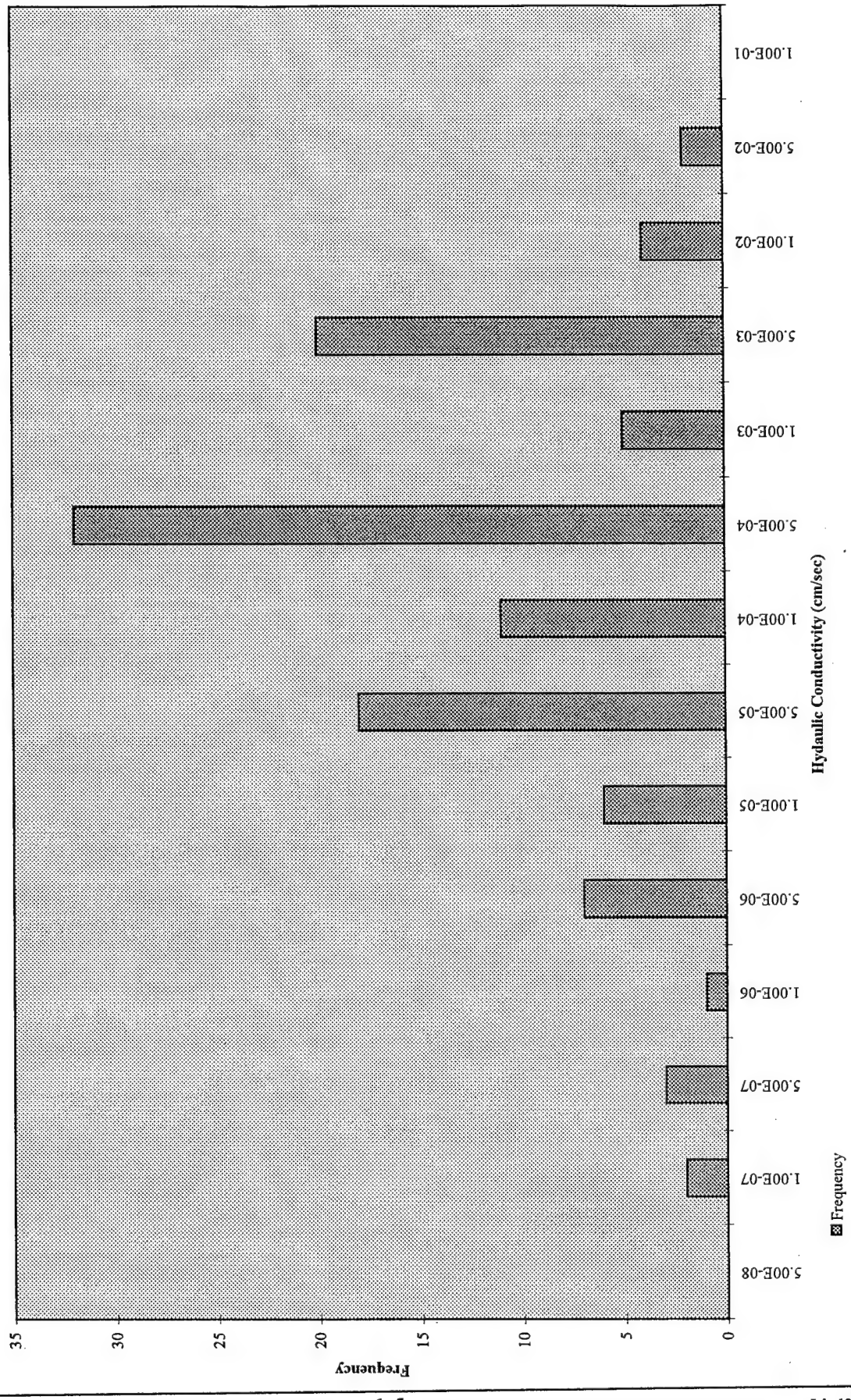


Figure 1-3. Histogram of Hydraulic Conductivities

Analysis of groundwater from monitoring well MW941148 (the closest existing monitoring well to the test area) showed the only organic contaminants detected were VOCs; metals were in a range consistent with acceptable background concentrations. Trichloroethylene (TCE) was the only contaminant (23 micrograms per liter [µg/L]) identified at this site.

The direct push investigation yielded 31 groundwater samples along and east of the base boundary. Most samples were analyzed by a mobile laboratory. The results revealed TCE in excess of 5 µg/L at 13 locations. The highest TCE concentration was 1,068 µg/L immediately north of water well ELN200 and about 600 feet east-northeast of MW941148. Other high concentrations (up to 227 µg/L) were detected north of MW941148 along the eastern base boundary in the vicinity of the site of this test.

Samples collected from EW-2 during this test indicated TCE concentrations of 36 to 45 µg/L.

2.0 TPE EXTRACTION TEST METHODOLOGY

The following information on the technical approach and the sampling and analytical methodologies is a summary of the *Ellsworth AFB OU-11, Vacuum Enhanced TPE Pilot Test Work Plan* (Radian, 1996). Additional details are contained in that document.

2.1 Test Procedures

The pilot-scale test of the TPE system consisted of a seven-day test conducted in the BG-04 plume on a new extraction well (EW-2) on the eastern base boundary. The test was completed 25 May 1996.

The locations of the test wells and monitoring points are shown in Figure 2-1. Well and piezometer characteristics are summarized in Table 2-1. Well logs are included in Appendix A.

2.1.1 Installation of Extraction Well and Piezometers

2.1.1.1 Extraction Well

The extraction well (EW-2) was installed in order to test TPE for the removal of TCE from groundwater from the BG-04 plume. The location was selected based upon limited data from previous direct push and seismic refraction data in the area. Well placement was planned to be within a bedrock paleochannel referred from the seismic refraction study in an area of elevated TCE concentrations.

The well was installed on 14 and 15 May 1996 using a hollow stem auger drilling rig with 10-inch outside diameter augers. Soil samples were collected continuously so that a lithologic log could be prepared (Appendix A). Samples were also collected for field headspace screening using a photoionization detector. The well was constructed with 4-inch diameter polyvinyl chloride (PVC) well casing and screen. The well casing, sand pack, and bentonite seal were installed through the augers to ensure the stability of the well bore. The well screen was placed in the upper portion of weathered shale and across the entire saturated section of alluvial deposits. The 10-foot long screen was placed from 13 to 23 feet below ground surface (BGS) with an additional 10 feet of blank casing from 23 to 33 feet BGS. A lithologic log and completion detail are contained in Appendix A.

Data from soil samples collected from EW-2 and the adjacent piezometers indicate that, if present, the paleochannel is only 1 to 2 feet lower in elevation than the surrounding weathered Pierre Shale bedrock.

After the well was completed, it was developed to remove silt and clay and ensure communication with the aquifer. The well was first surged with a 4-inch, vented, surge block to loosen up the fine material from the sand pack so that it could be removed. The well was then purged using a disposable bailer and down-hole submersible pump. Water quality was monitored during development by visually observing the silt and clay content of the water and by pH and turbidity measurements. Development was judged complete when the pH was stable and turbidity of the water had decreased to the satisfaction of the supervising geologist. Development logs are contained in Appendix A.

Prior to beginning the TPE test, a simplified step test was run on 16 May 1996 to estimate the flow rate that could be expected from the well. EW-2 was pumped with a down-hole submersible pump at flow rates of approximately 1, 2, 4.5, and 9.6 gallons per minute (gpm). Each step was run for a few minutes until the water level in the well stabilized or the well pumped dry. During this short duration test, the well was able to sustain a rate of approximately 4.5 gpm with the water level at the base of the screen.

2.1.1.2 Piezometers

The piezometers (P-1, P-2, and P-3) were installed in order to monitor the response of the aquifer to the test. Piezometers were located at distances of 10, 25, and 50 feet from extraction well EW-2. The locations were chosen such that data could be collected on the response of the saturated and unsaturated (vadose) zones to TPE. Well screens were placed in the upper portion of weathered shale and across the entire saturated

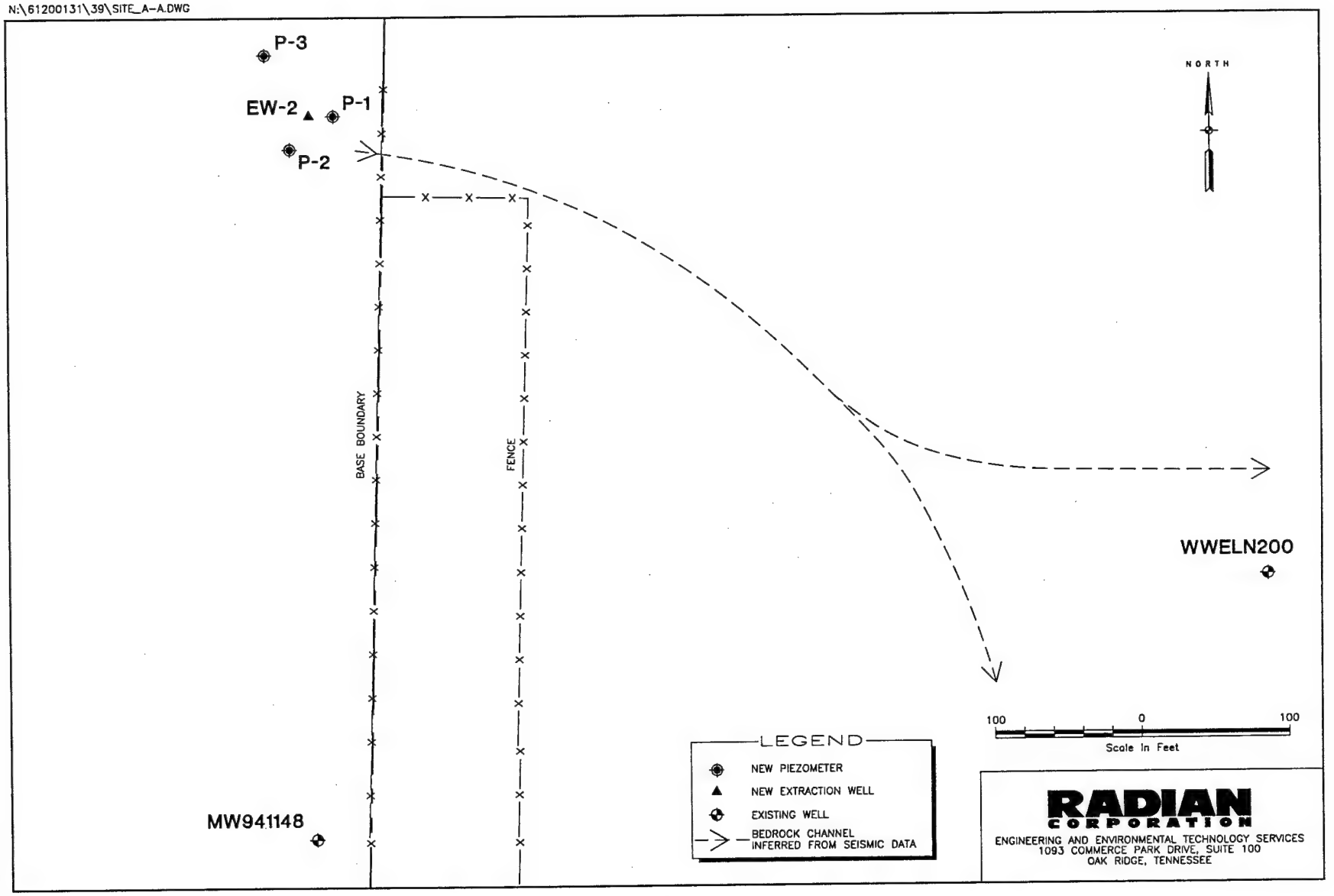


Figure 2-1. BG-04, Test Well and Monitoring Points, Ellsworth AFB

Table 2-1

Summary of Wells and Monitoring Point Characteristics

Well/ Piezometer ID	Used to Monitor	Total Depth (ft BGS)	Screened Interval (ft BGS)	Approximate Distance from EW-2 (ft)
P-1	Water Level/Induced Vacuum	23	13-23	10
P-2	Water Level/Induced Vacuum	23	12-22	25
P-3	Water Level/Induced Vacuum	23	13-23	50
EW-2	Extraction Well	33	13-23	0
MW941148	Monitoring Well	22	11-21	500

BGS = Below Ground Surface

section of alluvial deposits. The screens also extended several feet up into the unsaturated zone. This type of completion allows both water level drawdown in the aquifer and induced air vacuum in the vadose zone to be measured in the same well. Figure 2-1 shows the locations of the well and piezometers.

The piezometers were installed on 15 May 1996 using a hollow stem auger drilling rig with 6-inch outside diameter augers. Soil samples were collected from selected intervals in P-2 and P-3 so that lithologic logs could be prepared and for headspace screening (Appendix A). Soil samples were not collected from P-1 due to its proximity (10 feet) to EW-2. The piezometers were constructed with 2-inch diameter (PVC) well casing and screen. The well casing, sand pack, and bentonite seal were installed through the augers to ensure the stability of the well bore. The details of the wells are contained in the completion logs in Appendix A. In general, 10-feet long screens were placed within the weathered Pierre Shale at a depth of 13 to 23 feet below the ground surface.

After the piezometers were completed, they were developed to remove silt and clay and ensure communication with the aquifer. The wells were first surged with a 2-inch, vented, surged block to loosen up the fine material from the sand pack so that it could be removed. The piezometers were then developed in the same manner as the extraction well. Development logs are contained in Appendix A.

2.1.2 Test Equipment

The test was conducted using a trailer-mounted, 25-horsepower, high-vacuum extraction unit capable of producing an air flow rate of 300 cubic feet per minute (acfm) at 25 inches mercury. The system is shown in schematic in Figure 2-2. Extracted groundwater was discharged to temporary storage tanks; extracted vapor was discharged to the atmosphere. The wastewater was transported and discharged to the OU-1 treatment plant. Procedures followed during the testing are summarized in the work plan described in Section 2.0.

2.2 Sampling and Analytical Methodologies

All sampling and analytical procedures (except where noted) were conducted in accordance with procedures and protocols described in the U.S. Environmental Protection Agency (EPA)-approved Ellsworth AFB Quality Assurance Project Plan. Sampling locations and frequency are summarized in Table 2-2.

2.2.1 Sampling Methodology

System parameters and ambient air conditions were measured with various vacuum gauges, meters, and thermometers included on the mobile trailer. Groundwater drawdown in the observation wells was measured using an electronic water level meter, and induced vacuum

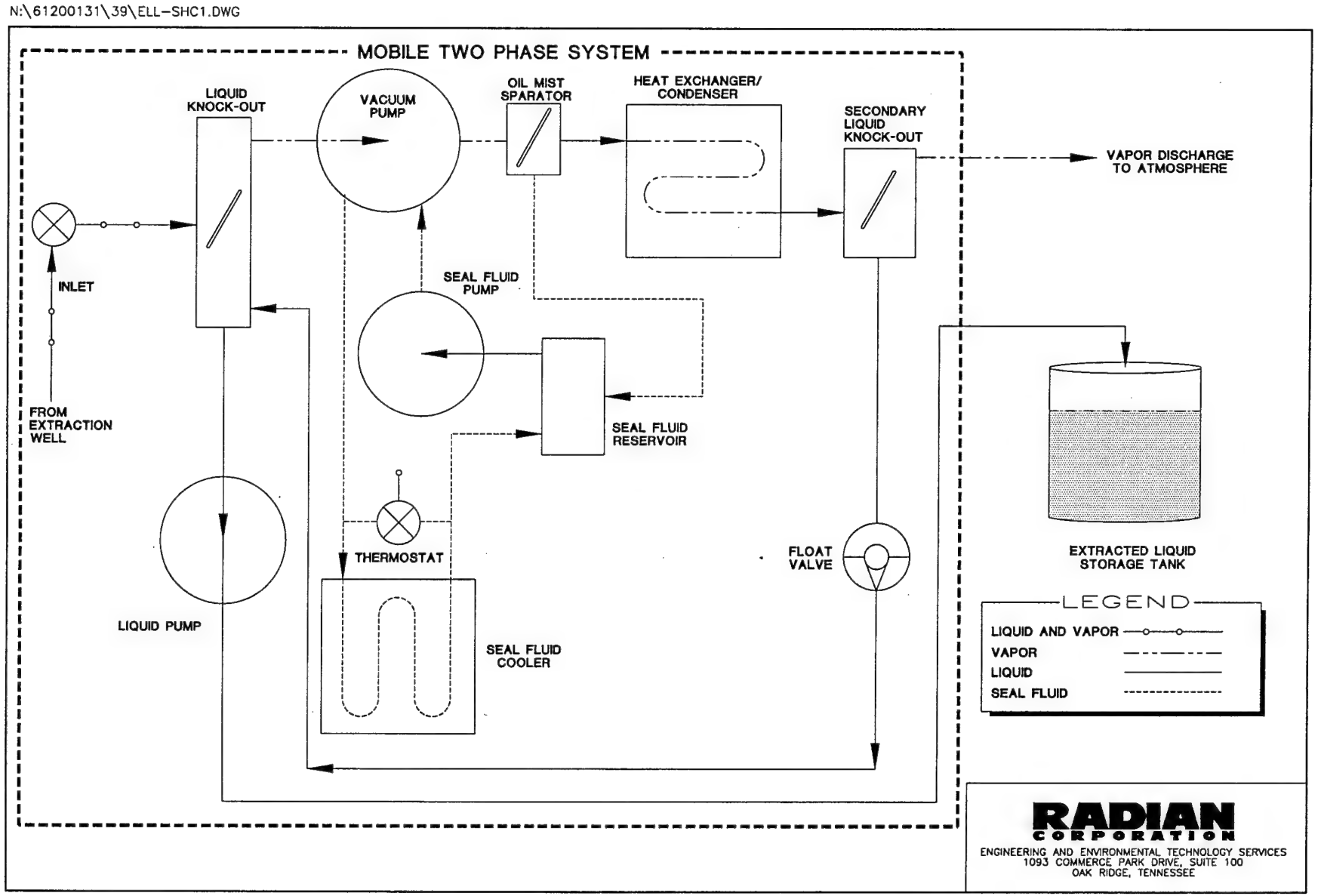


Figure 2-2. TPE System Schematic

was measured using Magnehelic® gauges. Data collected were recorded on field data tables (Appendix B).

Baseline groundwater samples from EW-2 were collected prior to TPE testing in 40-milliliter (mL) volatile organic analysis (VOA) vials using a dedicated Teflon® bailer. Prior to collecting the baseline samples, three well volumes of water were purged from the well. Approximately one hour after ending the test, post-test groundwater samples were collected using the dedicated bailer.

Water samples collected during the test were taken directly from the TPE trailer knock-out pot with VOA vials. All VOA vials were iced and stored in a dedicated cooler until shipped to Energy Laboratories, Inc., in Rapid City, South Dakota.

Vapor samples were collected using disposable syringes and evacuated vials provided by Microseeps Inc., Pittsburgh, Pennsylvania. Once the samples were collected, they were stored at ambient conditions until shipped to the Microseeps laboratory for analysis.

Quality control samples were also collected in the field. Duplicate water and vapor samples were collected at a 10% frequency by the methods previously described. Trip blanks accompanied the VOA vials throughout shipping and handling.

2.2.2 Analytical Methodology

Groundwater samples were analyzed for VOCs by EPA Method SW 8260. Soil vapor samples were analyzed for VOCs by Microseeps Analytical Method AM 4.03.

Table 2-2

Frequency of Sample Collection and Source Monitoring

Schedule									
Day	Hour	Ambient Barometric Pressure	Measure Water Level at Test Well	Groundwater Sample from Test Well	Water Levels at Groundwater Piezometers	Effluent Vapor Samples	Induced Vacuum at Soil Vapor Monitoring Probes	System Parameters	Water Samples from Knock-Out Pot
0	Before	X	X	X	X				
1	0.25				X	X	X	X	
1	.75					X			X
1	1				X		X	X	
1	1.5	X			X		X	X	
1	2				X	X	X	X	X
1	5	X			X	X	X	X	X
2	0	X			X	X	X	X	X
2	1.5				X		X	X	
2	4				X		X	X	
2	6				X	X	X	X	X
2	8	X			X		X	X	
3	0	X			X	X	X	X	X
3	2				X		X	X	
3	2.5				X		X	X	
3	5				X		X	X	
3	8				X		X	X	X
3	13.5				X		X	X	
4	0				X				
4	0.5				X		X	X	
4	1.5				X	X	X	X	X
4	5				X		X	X	
4	5.5				X		X	X	
4	7				X	X	X	X	X
4	8				X		X	X	
5	0				X	X	X	X	X
5	7				X	X	X	X	X
6	0				X		X	X	
6	2.5				X	X	X	X	X
6	4.5				X		X	X	
6	7.5				X	X	X	X	X
7	0				X		X	X	
7	0.5				X	X	X	X	X
7	Post Test		X	X	X				

Note: Groundwater/water samples analyzed for VOCs by Method SW-8260. Vapor samples analyzed for VOCs by Microseeps Analytical Method AM 4.03.

3.0 TEST RESULTS AND CONCLUSIONS

A critical step toward adding another presumptive remedy to the PREECA process is to compare that remedial technology's test results, referred to here as the "site-specific profile," to its PREECA remedy profile and determine the extent to which the two profiles match. The remedy profile comprises the performance data (including site selection criteria, process and methodology descriptions, and the acceptable range of quantitative results) by which the effectiveness of the presumptive remedy will be judged.

Radian performed a seven-day test on the EW-2 well at the BG-04 site. Table 3-1 summarizes the results achieved using the TPE system at the EW-2 well. The results of this test are described in Section 3.4.

Table 3-1

Summary of Results

System Parameter	EW-2
Groundwater Extraction Rate	2-3 gpm
Soil Vapor Extraction Rate	15-30 scfm
Contaminant Removal Rate	0.003 lb/day
Radius of Influence (Groundwater)	>70 ft

gpm = gallons per minute
scfm = standard cubic feet per minute

Based on the results of the pilot-scale TPE test conducted at Ellsworth AFB BG-04, Radian has constructed a site-specific profile for BG-04. A comparison of this site-specific profile to the general MPE profile and the specific TPE, LVDPE, and HVDPE profiles are presented in Tables 3-2 and 3-3. Note that the BG-04 profile falls within the general MPE profile and compares favorably with the corresponding TPE remedy profile.

3.1 System Operation

Physical and analytical data were analyzed to determine the following:

- Baseline VOC concentrations in groundwater;
- The major VOC constituents in the vapor and water streams;
- Average groundwater and soil vapor extraction rates;
- Average VOC extraction rates and total pounds of VOCs removed;
- The relationship between time and VOC concentrations;
- The relationship between time and vapor and water flow rates; and
- The relationship between distance and groundwater drawdown and induced vacuum, including radi of influence.

3.2 Radii of Influence and Production Rates

The following sections describe groundwater and vapor production rates and radiis of influence.

3.2.1 Groundwater

The groundwater flow rate was measured using a totalizing flow water meter and is plotted along with the vapor flow rate on Figure 3-1. Water table drawdown was measured in piezometers P-1, P-2, and P-3 (Appendix B). A plot of drawdown vs time is presented in Figure 3-2. A plot of drawdown vs distance at the end of the BG-04 test is presented in Figure 3-3.

Table 3-2

MPE Technology Selection Criteria for BG-04

Criteria Parameter	BG-04 Site	Guideline
Contaminant	TCE	Halogenated VOCs, and non-halogenated VOCs and TPH for sites where expedited action is required
Contamination location	Saturated zone	Saturated zone alone or saturated and vadose zones combined
Contaminant concentration	36-45 µg/L	Significantly greater than MCLs MCL = 5.0 µg/L
Henry's Law Constant of majority of contaminants	0.297 at 20 C°	> 0.01 at 20 C° (dimensionless)[1]
Vapor pressure of majority of contaminants	58 mm Hg at 20 C°	> 1.0 mm Hg at 20 C°
Lithology of saturated zone	Clayey-gravel and weathered Pierre Shale	Sands to Clays
Natural groundwater production rate	Est. approximately 2 gpm	No limitations
Depth of contamination in vadose zone (if targeted)	N/A	> 5 feet BGS (MPE not applicable < 5 feet BGS)
Average air permeability of vadose zone (if targeted)	N/A	Low permeability (< 1 x 10^{-3}) and moderate permeability (between 1 x 10^{-3} darcy and 0.1 darcy) soils.

[1] Dimensionless Henry's Law Constant in the form: (concentration in gas phase) / (concentration in liquid phase)

BGS = Below Ground Surface
Hg = Mercury
MCL = Maximum Contaminant Level
mm = Millimeter
MPE = Multi Phase Extraction
N/A = Not applicable
TCE = Trichlorethylene
TPH = Total Petroleum Hydrocarbon
VOC = Volatile Organic Compound

Table 3-3

LVDPE, HVDPE, and HVTPE Technology Selection Criteria for BG-04

Criteria Parameter	BG-04 Site	LVDPE Guideline	HVDPE Guideline	Guideline HVTPE
Groundwater production rate[1]	2.2 gpm (under vacuum)	> 2 gpm[2]	no limitations	< 5 gpm
Depth of targeted contamination	> 18-23 feet BGS	no limitations	no limitations	up to 50 BGS ± (for groundwater production < 1 gpm) up to 20-30 BGS (for groundwater production = 5 gpm)
Lithology of saturated zone	clayey gravel and weathered shale	sands to silty sands	sandy silts to clays	sandy silts to clays
Average air permeability of vadose zone (if targeted)	N/A - not targeted	moderate permeability (between 1 x 10^{-3} darcy and 0.1 darcy)	low permeability (less than 1 x 10^{-3} darcy)	low permeability (less than 1 x 10^{-3} darcy)

[1] For MPE, the aquifer must be able to be dewatered.
[2] For flows < 2 gpm, pneumatic pumps may be used in place of submersible pumps

BGS = Below Ground Surface
gpm = Gallons per minute
N/A = Not applicable

Figure 3.1 BG-04 Vapor and Liquid Flow Rates

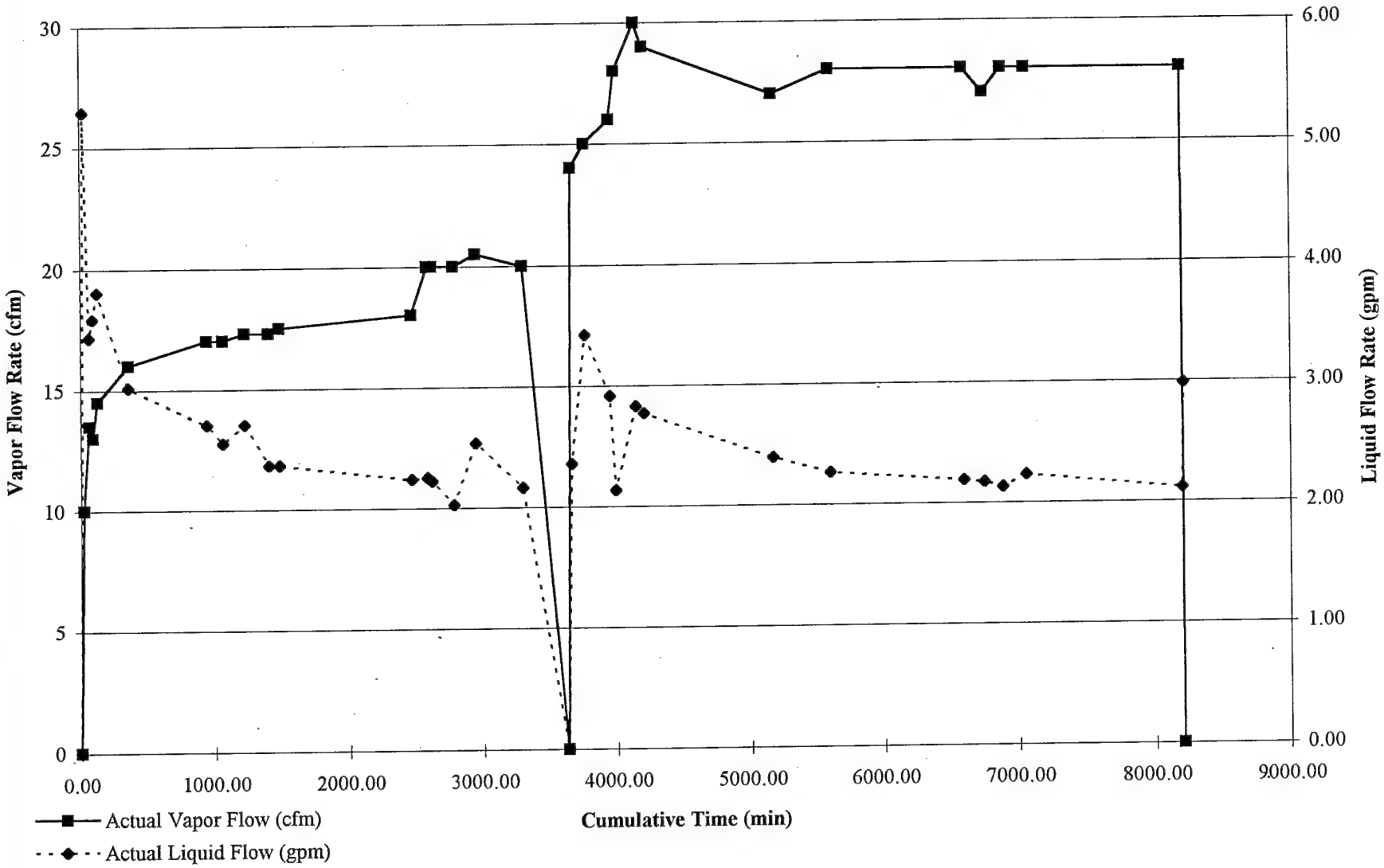
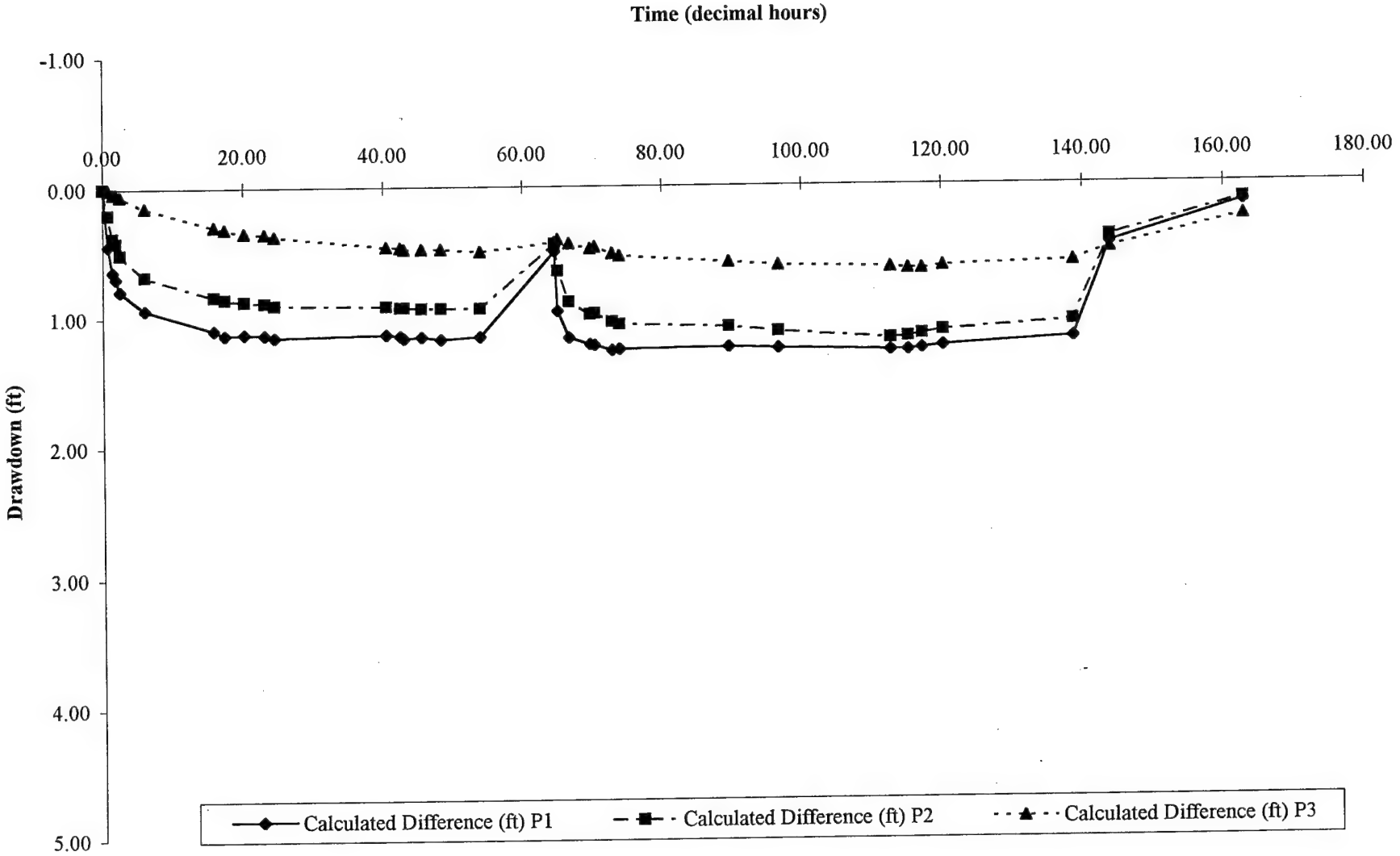


Figure 3.2 BG-04 Water Level Drawdown Over Time



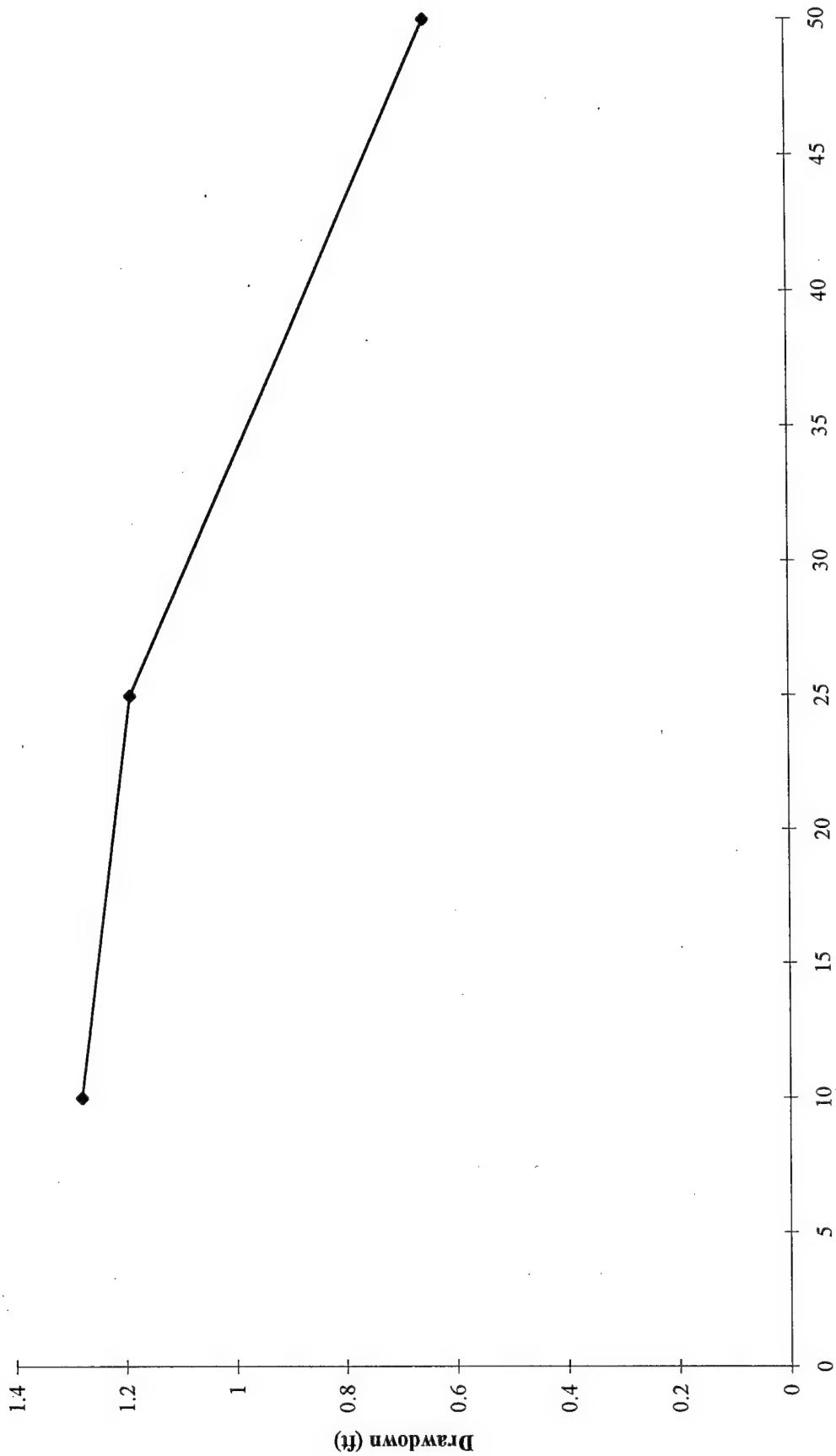


Figure 3-3 BG-04 Drawdown Vs. Distance

During the BG-04 test, the groundwater flow rate surged at the beginning of the test due to evacuation of the well and sand pack, as well as from dewatering of the sand and gravel deposits near the well. After the initial surge, the water production rate fell slowly before stabilizing at approximately 2.2 gpm (Figure 3-1). The maximum radius of influence (defined as 0.1 feet of drawdown) is estimated to be approximately 70 feet based on the available data.

3.2.2 Vapor

The vapor flow rate was measured using rotameters located at the skid and is plotted along with the vapor flow rate on Figure 3-1. Induced vacuum was measured in piezometers P-1, P-2, and P-3 (Appendix B). A plot of the induced vacuum vs distance at the end of the BG-04 test is presented in Figure 3-4.

During the BG-04 test, vapor flow steadily increased during the first 80 hours of the test. During the latter portion of the test the flow rate stabilized at approximately 27 standard cubic feet per minutes (scfm). The increase in flow during the first 80 hours of the test occurred as the formation was dewatered and the relative permeability to vapor increased.

The radius of influence of the vapor is greater than 50 feet based on the available data. Significant vacuums were measured in the adjacent piezometers with values between 3.7 and 8.6 inches of water at the end of the test.

3.3 VOC Recovery

Table 3-4 summarizes analytical results for the VOCs detected in the samples collected during the test. TCE was the only contaminant found at the site (see Appendices C and D for the analytical laboratory results and chain-of-custody forms). Results of VOC sampling at EW-2 included:

- The baseline concentration (pre- test) of TCE in groundwater from EW-2 was 45 µg/L;
- The post-test concentration of TCE was 36 µg/L;
- The TCE concentration in the extracted water (collected from knock-out pot) averaged 2.4 µg/L. All samples contained less than the maximum contaminant level (MCL) of TCE (5.0 µg/L); and
- The TCE concentration in extracted vapor averaged 0.28 parts per million by volume (ppmv).

3.3.1 Extraction Results

Results of the BG-04 test included:

- Approximately 0.016 pounds of TCE was extracted from EW-2 in 162 hours of testing. The vast majority of the mass was extracted in the vapor phase.
- Average groundwater extraction rate was 2.4 gpm. Approximately 19,466 gallons of contaminated groundwater were extracted.
- Average vapor extraction rate from the formation was 20.7 scfm.
- The TPE extraction system transferred over 95% of the VOCs in the groundwater to the vapor phase, resulting in decreased concentrations in the water phase and reduced treatment cost.

3.3.2 VOC Removal Over Time

The graph showing VOC removal over time at the test well is provided in Figure 3-5. In general, steady concentrations in both extracted vapor and water were achieved after approximately 20 hours of testing.

Ninety-eight percent of the total VOCs removed were from the vapor phase and the remaining 2

percent were in the water phase. Much of this mass was stripped from the groundwater, but some was volatilized from the sediments as the formation dewatered.

3.3.3 Two Phase Extraction vs Pump and Treat Comparison

A comparison of mass removal rates over time was made between groundwater pump and treat and TPE. The comparison estimated pumping 19,466 gallons of groundwater (the volume removed during this test) with an average contaminant concentration of 40.5 µg/L of TCE (the average of the per- and post-test samples). The mass contained in this volume of water was compared to the measured mass extracted during the TPE test. This comparison shows that TPE would extract 2.4 times the amount of mass over pump and treat. These calculations are presented in Appendix E.

Figure 3-4 BG-04 Induced Vacuum Vs. Distance

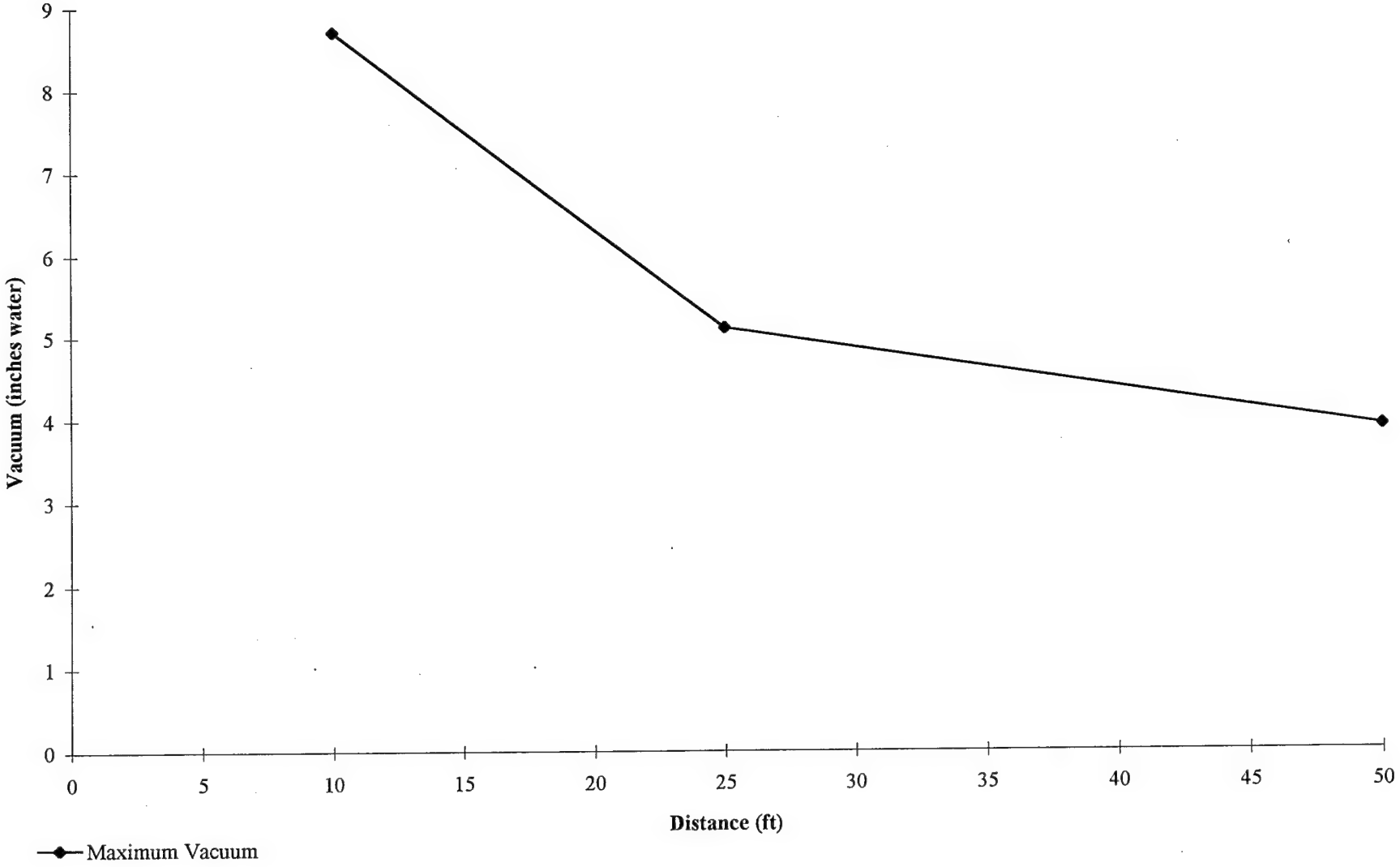
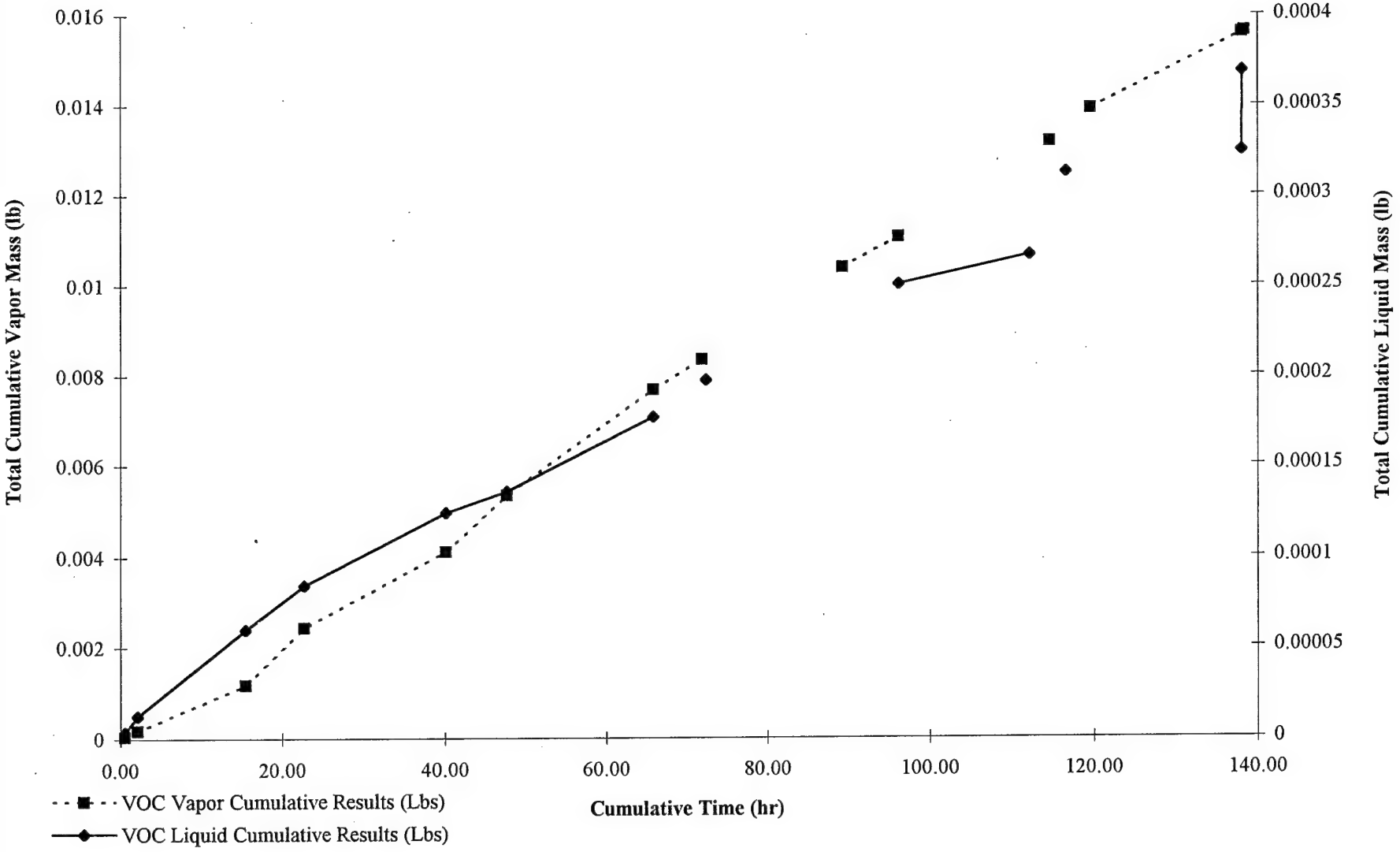


Table 3-4

Summary of Vapor and Water Data
Concentrations in Micrograms per Liter (μg/L) - Water and Parts per Million by Volume (ppmv) - Vapor

Extracted Water Concentration		Extracted Vapor Concentration	
Sample ID	Trichloroethylene	Sample ID	Trichloroethylene
EW-2 Pre-Test	45	V1	0.366
Effluent-1	3.3	V2	0.315
Effluent-2	2.9	V3	0.222
Effluent-3	2.5	V4	0.492
Effluent-4	2.5	V5	0.267
Effluent-5	2.0	V6	0.400
Effluent-6	2.0	V7	0.386
Effluent-7 (Dup)	2.5	V7Dup	0.306
Effluent-7D	2.5	V8	0.205
Effluent-8	2.5	V9	0.201
Effluent-9	2.2	V10	0.171
Effluent-10	2.0	V11	0.202
Effluent-11	2.2	V12	0.257
Effluent-12	2.1	V13	0.160
Effluent-13	2.2		
EW-2 Post-Test	36		

Figure 3-5. BG-04 Total Mass of VOCs Removed Over Time (water and Vapor)



3.4 Conclusions

3.4.1 Hydrogeologic Conclusions

A sustained flow rate of approximately 2.2 gpm and was generated during the TPE test. Most of the water production is believed to have been from moderately permeable saturated alluvium consisting of a heterogeneous mixture of clay, silt, sand, and gravel overlying weathered Pierre Shale bedrock. Hydraulic conductivities were measured in the BG-04 test area by a slug test in EW-2 and a recovery test in P-1 and were 1.3 x 10^{-3} and 2.1 x 10^{-2} centimeters per second (cm/s), respectively. This variability is consistent with the nature of the deposits at the site. These values are also consistent with hydraulic conductivities measured elsewhere on the Base, as shown in Figure 1-3.

Sustained flow rates from the TPE test (2.2 gpm) under a well head residual vacuum of 12 in of mercury were less than those achieved from the short duration step-rate pumping test (4.5 gpm). This is because the longer duration TPE test began dewatering portions of the saturated zone and the higher well yields could not be sustained. At a distance of 25 feet, the saturated thickness in P-2 decreased by approximately 25% during the test period.

A stabilized vapor flow rate of approximately 27 scfm was developed near the end of the TPE test. Flow was established through the more permeable gravel interval.

3.4.2 Technology Evaluation

The TPE test on well EW-2 at the BG-04 site demonstrated that TPE is effective in simultaneously removing volatile contaminants from both the vadose zone and groundwater in moderate-permeability formations. Although this site did not appear to have significant vadose zone contamination, the high vapor flow rate and high formation vacuums indicate that vadose zone removal would have occurred. The results support the existing remedy profile for TPE because the site conditions fall within the bounds of the current TPE profile.

This site demonstrated a classical response to TPE. Groundwater flow rate declined early in the test and stabilized at 2-3 gpm as the formation dewatered. Vapor flow increased through the test and stabilized at 25-30 scfm as the subsurface dewatered and desiccated. Complete drawdown of the saturated zone into the Pierre Shale (23 feet) was obtained in EW-2.

Approximately 20,000 gallons of TCE-contaminated groundwater were removed during the seven-day test. This water was stripped by the process to below maximum contaminant levels (MCLs) without additional treatment. Approximately 98 percent of the TCE removed was in the vapor phase, indicating excellent stripping efficiency from the groundwater. Additional TCE was volatilized from the sediments as the formation dewatered. Both hydraulic and vacuum radii of influence were greater than 50 feet. Calculations indicate that TPE would likely result in a contaminant removal rate at least 2-3 times greater than could be obtained with traditional pump and treat at this site.

4.0 BASE-SPECIFIC RECOMMENDATIONS

Ellsworth AFB is planning a time-critical removal action to address the off-base plume at BG-04. The results of this test indicate that the TPE process could be effective in remediating this plume and controlling the further migration of the main plume off base.

Recent data collected by RUST indicate that the highest TCE concentrations in the off-base plume area are on the base fence line near EW-2 (22-44 micrograms per liter [ug/L]) and along the E-W road approximately 3,000 feet southeast of EW-2 (25-34 ug/L). Low concentrations have been detected further southeast (downgradient). It is possible that contamination has migrated rapidly along paleochannels eroded into the surface of the Pierre Shale.

A TPE system is probably the most aggressive technology available to contain and remediate this plume. It would likely result in an accelerated TCE cleanup rate over conventional technologies and remediate the site in the shortest possible time. To reach these goals, it is recommended that a TPE system be installed along the base boundary to prevent further off-base migration of the plume, effectively cutting off a continuing source. A second system installed along the E-W road would effectively isolate the highest concentration portion of the plume and prevent it from spreading while helping to remediate this portion of the plume in an accelerated time frame.

The stripping efficiency of the TPE process demonstrated at this site should allow the direct surface discharge of the extracted groundwater at concentrations below the MCL without the need for construction of a treatment plant or hauling of the water. This water could be discharged to stock ponds, such as the one located near the fence line, for beneficial reuse by local ranchers and farmers.

5.0 REFERENCES

Radian Corporation, 1996. *Ellsworth AFB Operable Unit 11 Two-Phase Vacuum Extraction Pilot-Scale Test Work Plan,* Ellsworth AFB, South Dakota, April.

U.S. Air Force, 1995. *United States Air Force Presumptive Remedy Engineering Evaluation/Cost Analysis (PREECA),* Final, 5 May.

EA Engineering, Science, and Technology 1995. *Remedial Investigation Report, OU-11 Ellsworth AFB, SD, September.*

Rust Environment and Infrastructure 1995. *Technical Memorandum, Summary and Recommendations for Further Characterization of TCE Contamination at BG-04, Ellsworth AFB, SD,* 6 November.

Rust Environmental and Infrastructure 1996. *Seismic Refraction Survey, BG-04/TCE Investigation,* Ellsworth AFB, SD, January.

APPENDIX A

Well Drilling and Development Logs

SINGLE COMPLETION WELL CONSTRUCTION LOG

Well Number EW-2

Project Ellsworth 2-Phase Test

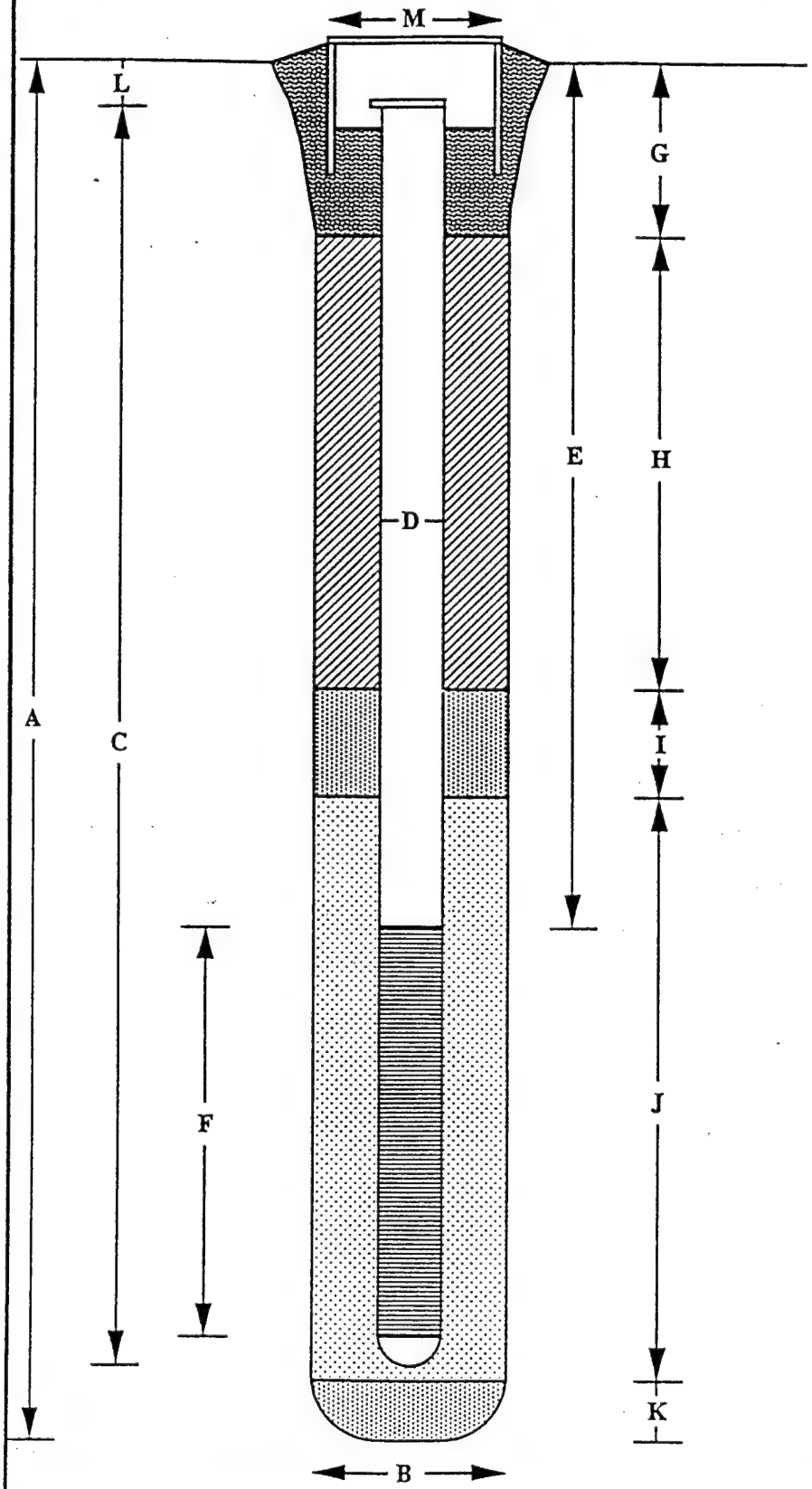
Project Number 612-001-31-30

Location BG-04 Plume (A-11

Datum Ground Surface

Top of Casing Elevation _____

Ground Surface Elevation _____



BORING

A. Total Depth (ft) 33

B. Boring Diameter (in.) 10 3/4

Drilling Method Hollow-Stem Auger

WELL CONSTRUCTION

C. Casing Length (ft) 33

Type Sch 40 PVC

D. Casing Diameter (ft) 0.33

E. Depth to Top of Slotted Interval (ft) 13

F. Perforated Casing Length (ft) 10

Perforated Interval From 13 to 23 ft

Perforation Type Continuous Slot

Perforation Size 0.02"

G. Surface Grout Interval (ft) 0-10

Grout Material Portland Cement

H. Backfilled Interval (ft) NA

Backfill Material NA

I. Sealed Interval (ft) 10-12

Seal Material Bentonite Pellets

J. Filter Pack Interval (ft) 12-25

Pack Material 10/20 Silica Sand

K. Bottom Seal Interval (ft) 24-25

Seal Material Bentonite Pellets

L. Depth to Top of Casing (in) _____

M. Protective Casing Diameter (in) _____

Blank casing from 23 to 33 ft.

DRILLING LOG

HOLE NO. EW-2

F3248

1. COMPANY NAME: Radian	2. DRILLING SUBCONTRACTOR: Maxim Technologies
SHEET 1 OF 1 SHEETS 2	
3. PROJECT: Ellsworth 2-Phase Test/BG-04	4. LOCATION
5. NAME OF DRILLER: Ken Dent	6. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 10 3/4-in hollow stem augers, continuous core barrel.	8. HOLE LOCATION: OU-11 BG-04 Plume
	9. SURFACE ELEVATION
	10. DATE STARTED: 5-14-96 — 11. DATE COMPLETED: 5-15-96
12. OVERBURDEN THICKNESS: 20ft.	15. DEPTH GROUNDWATER ENCOUNTERED: 17 ft
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES
			NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY
NA						%

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Extraction Well				

GRAPHIC LOG a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	SAMPLE INTERVAL f	RECOVERY g	REMARKS h
	1	Sandy Clay. Top soil, roots, grass, sticky, becomes silty at base.	HS=ϕ 0-2 ft				BZ=ϕ
	2	Sandy Clay. Brown 7.5 YR 4/2, sticky, moist, occassional pebbles and cobbles 4" diameter. Grades into clayey sand.			0-5'	4'8"	Soil=ϕ
	3	CL	HS=ϕ 3-4 ft				
	4						
	5	Clayey Sand Fine grained, mod. to well sorted, silty, moist, 10YR 4/3, brown.					
	6	SC	HS=ϕ 6-7 ft				Soil=ϕ
	7				5'-10'		
	8						
	9		HS=ϕ 9-10 ft.				
	10	Sandy-Clay CL					BZ=ϕ

PROJECT: Ellsworth 2-Phase — HOLE NO.: EW-2

DRILLING LOG

HOLE NO. EW-2

PROJECT Ellsworth 2-Phase | INSPECTOR Gary Dyla | SHEET 2 OF 2 SHEETS

GRAPHIC LOG a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	SAMPLE INTERVAL f	RECOVERY g	REMARKS h
	10–13	Sandy Clay Yellow Brown 10 YR 6/6, moist, mixed with fine sand and occassional pebbles. CL	HS=ϕ 10-12'		10-15'	5'	Soil Screen=ϕ
	14–20	Clayey Gravel Brown, to Yellow Brown. Very poorly sorted, loose to sticky with clay, highly variable composition, cobbles to 6" diameter. Saturated at 17 ft. GC	HS=ϕ 14-15'		15-20	3'5"	BZ=ϕ
	20–28	Weathered Pierre Shale Light Olive Brown 2.5 Y 5/6, wet and becomes moist with depth, varicated coloring, sticky to plastic. TOTAL DEPTH = 33 ft. - not sampled			20-25	5'	BZ=ϕ
					25-30	5'	
	29–30						

PROJECT Ellsworth 2-Phase HOLE NO. EW-2

SINGLE COMPLETION WELL CONSTRUCTION LOG

Well Number P-1

Project Ellsworth 2-Phase

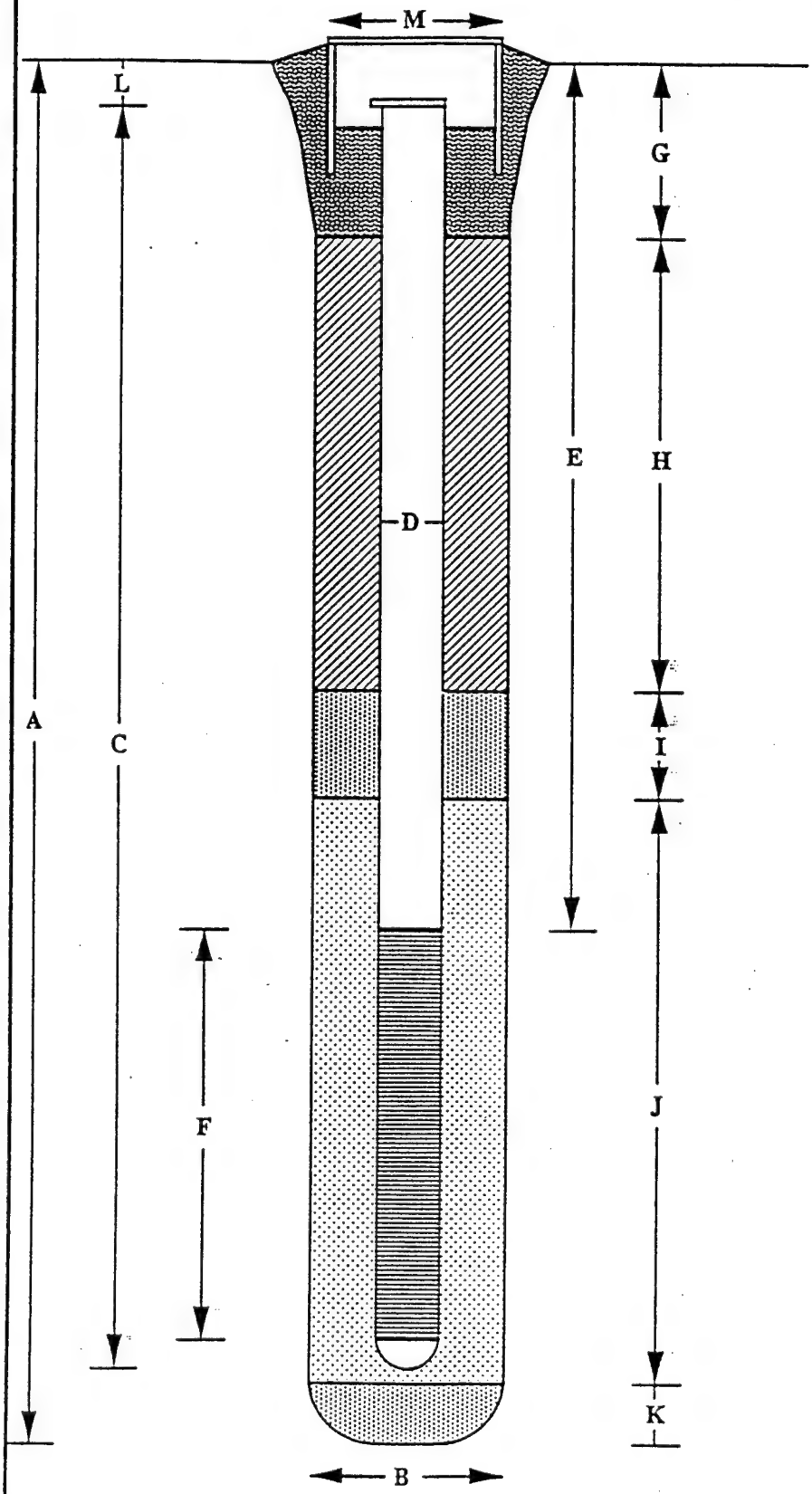
Project Number 612-001-31-30

Location BG-04 Plume

Datum Ground Surface

Top of Casing Elevation _____

Ground Surface Elevation _____



BORING

A. Total Depth (ft) 23

B. Boring Diameter (in.) 6

Drilling Method Hollow Stem Auger

WELL CONSTRUCTION

C. Casing Length (ft) 23

Type Schedule 40 PVC

D. Casing Diameter (ft) 0.167

E. Depth to Top of Slotted Interval (ft) 13

F. Perforated Casing Length (ft) 10

Perforated Interval From 13 to 23 ft

Perforation Type Continuous Slot

Perforation Size 0.01"

G. Surface Grout Interval (ft) 0-9

Grout Material Portland Cement

H. Backfilled Interval (ft) NA

Backfill Material NA

I. Sealed Interval (ft) 9-11

Seal Material Bentonite Chips

J. Filter Pack Interval (ft) 11-23

Pack Material 10/20 Silica Sand

K. Bottom Seal Interval (ft) NA

Seal Material _____

L. Depth to Top of Casing (in) _____

M. Protective Casing Diameter (in) _____

SINGLE COMPLETION WELL CONSTRUCTION LOG

Well Number P-2

Project Ellsworth 2-Phase

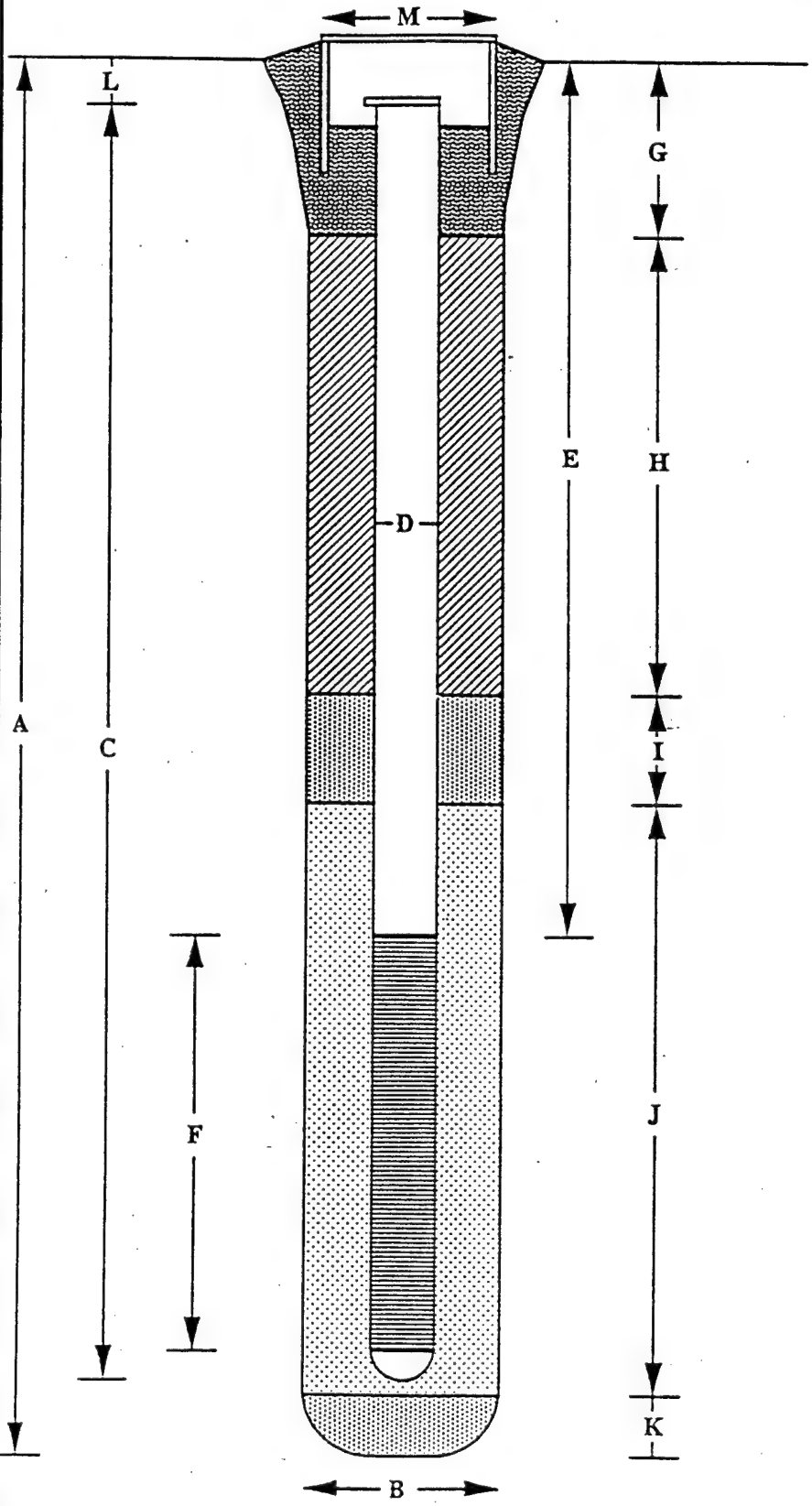
Project Number 612-001-31-30

Location BG-04 Plume

Datum Ground Surface

Top of Casing Elevation _____

Ground Surface Elevation _____



BORING

A. Total Depth (ft) 23

B. Boring Diameter (in.) 6

Drilling Method Hollow Stem Auger

WELL CONSTRUCTION

C. Casing Length (ft) 23

Type Schedule 40 PVC

D. Casing Diameter (ft) 0.167

E. Depth to Top of Slotted Interval (ft) 12

F. Perforated Casing Length (ft) 10

Perforated Interval From 12 to 22 ft

Perforation Type Continuous Slot

Perforation Size 0.01"

G. Surface Grout Interval (ft) 0-8

Grout Material Portland Cement

H. Backfilled Interval (ft) NA

Backfill Material NA

I. Sealed Interval (ft) 8-10

Seal Material Bentonite Chips

J. Filter Pack Interval (ft) 10-22

Pack Material 10/20 Silica Sand

K. Bottom Seal Interval (ft) NA

Seal Material NA

L. Depth to Top of Casing (in) _____

M. Protective Casing Diameter (in) _____

DRILLING LOG

HOLE NO. P-2

1. COMPANY NAME: Radian	2. DRILLING SUBCONTRACTOR: Maxim Technologies
3. PROJECT: Ellsworth 2-Phase / BG-04 Plume	4. LOCATION
5. NAME OF DRILLER: Ken Dent	6. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 6-inch hollow stem augers, continuous core barrel.	8. HOLE LOCATION: BG-04 Plume - OU-II
	9. SURFACE ELEVATION
	10. DATE STARTED: 5-15-96 / 11. DATE COMPLETED: 5-15-96
12. OVERBURDEN THICKNESS: 18ft	15. DEPTH GROUNDWATER ENCOUNTERED: 15 1/2 ft
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 23 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Piezometer				

GRAPHIC LOG a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	SAMPLE INTERVAL f	RECOVERY g	REMARKS h
	1	Silty clay Brown, plastic, moist roots and grass in to 6". CL	HS=ϕ 2-4'		0-5'	5'	BZ=ϕ
	2						
	3	Sand Brown 7.5YR 5/3, well sorted, medium to fine grained, dry, loose, silty. SM					
	4						
	5						
	6	Sandy Silt Brown, 10YR 4/3, mixed w/ medium to fine sand, friable, dry. MH			5-10	4'1"	
	7						
	8						
	9	Sandy clay Brown, 10YR 5/3 moist, slightly plastic. CL	HS=ϕ 5-9'				BZ=ϕ
	10						

PROJECT: Ellsworth 2-Phase HOLE NO. P-2

DRILLING LOG

HOLE NO. P-2

PROJECT Ellsworth 2-Phase | INSPECTOR Gary Dyke | SHEET OF 2 SHEETS 2

GRAPHIC LOG a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	SAMPLE INTERVAL f	RECOVERY g	REMARKS h
	10	Sandy Clay - as above					BZ=ϕ
	11	CL					
	12	Clayey Gravel - Yellow Brown, very poorly sorted, clay to cobbles, subround pebbles, variable color, loose. Saturated at 15½ ft.			10-15'	3'	Soil=ϕ
	13		HS=ϕ 10-13				
	14	GC					
	15						
	16						
	17	Gravel - Poorly sorted, No Clay in matrix. Saturated GW			17-20	2'	
	18		HS=ϕ 17-18				
	19	Weathered Pierre Shale					BZ=ϕ
	20	Plastic, light-olive gray, damp to moist.					
	21				20-23	3'	
	22						
	23						
	24	Total Depth = 23 ft.					
	25						
	26						
	27						
	28						

PROJECT Ellsworth 2-Phase | HOLE NO. EW-2

DRILLING LOG

HOLE NO. P-3

13248

1. COMPANY NAME: Radian	2. DRILLING SUBCONTRACTOR: Matrix Technologies
SHEET 1 OF 1 SHEETS 2	
3. PROJECT: Ellsworth 2-Phase Test / BG-04	4. LOCATION
5. NAME OF DRILLER: Ken Dent	6. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: 6-inch hollow stem augers; continuous core barrel	8. HOLE LOCATION: BG-04 Plume-OU-11
	9. SURFACE ELEVATION
	10. DATE STARTED: 5-15-96 — 11. DATE COMPLETED: 5-15-96
12. OVERBURDEN THICKNESS: 18 ft	15. DEPTH GROUNDWATER ENCOUNTERED: 18 ft
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE: 23 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES: NA

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %

22. DEPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
Piezometer				

GRAPHIC LOG a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	SAMPLE INTERVAL f	RECOVERY g	REMARKS h
	1	Silty Sandy Clay Dark Brown, roots + grass, 7.5 YR 2.5/2 plastic, moist. CL	HS=0 1-3'				BZ=1
	2						
	3	Silt Brown 10 YR 4/3, friable, some fine sand, becomes clayey near bottom. MH			0-5	4' 1"	
	4						
	5						
	6		HS=0 5-8'				
	7				5-10	3' 8"	
	8	Sandy Clay Brown 10 YR 5/3, some fine to medium sand, moist, slightly plastic, small pebbles. CL					BZ=0
	9						
	10						

PROJECT: Ellsworth 2-Phase — HOLE NO. P-3

DRILLING LOG

HOLE NO. P-3

PROJECT Ellsworth 2-Phase | INSPECTOR Gary Dyke | SHEET OF 2 SHEETS 2

GRAPHIC LOG a	DEPTH b	DESCRIPTION OF MATERIALS c	FIELD SCREENING RESULTS d	GEOTECH SAMPLE OR CORE BOX NO. e	SAMPLE INTERVAL f	RECOVERY g	REMARKS h
///	10	Sandy Clay					
o o o	11	Clayey Gravel Brown, variable color, very poorly sorted, cobbles to 2" diameter, cohesive to loose, variable clay content Wet at 18 ft.			10-15	2'	BZ=ϕ Soil=ϕ
o o o	12						
o	13						
o	14	GC					
o o p	15						
o o	16						
o	17				17-20'	3'	
o o	18						
	19	Weathered Pierre Shale Light olive brown, 7.5 YR 5/4, moist variable color.					BZ=ϕ Soil=ϕ
	20		HS=ϕ 20-23				
	21				20-23	3'	
	22						
	23						
	24	Total Depth 23 ft.					
	25						
	26						
	27						
	28						

PROJECT Ellsworth 2-Phase | HOLE NO. P-3

SINGLE COMPLETION WELL CONSTRUCTION LOG

Well Number P-3

Project Ellsworth 2-Phase

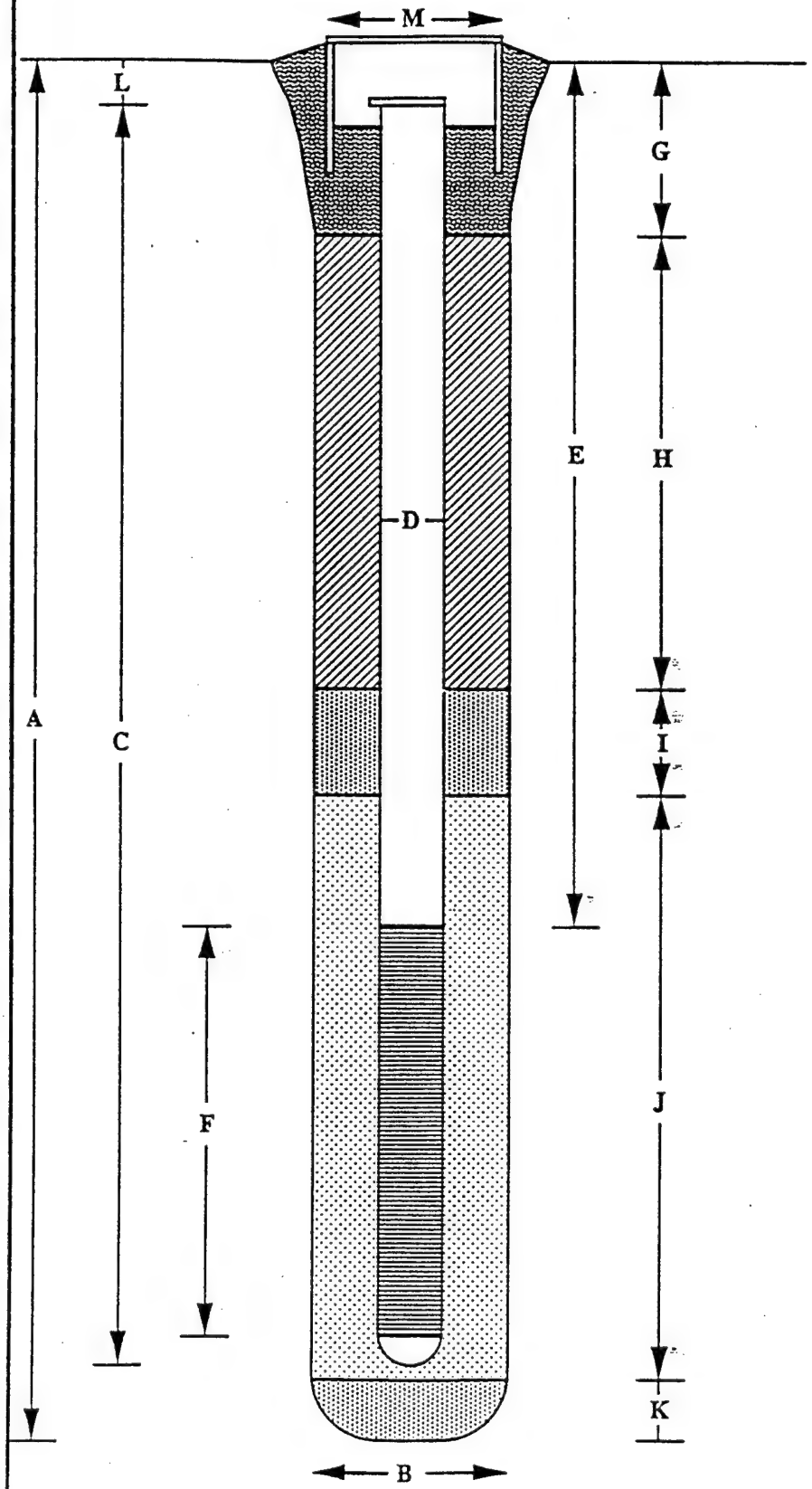
Project Number 612-001-31-30

Location BG-04 Plume

Datum Ground Surface

Top of Casing Elevation _____

Ground Surface Elevation _____



BORING

A. Total Depth (ft) 23

B. Boring Diameter (in.) 6

Drilling Method Hollow Stem Auger

WELL CONSTRUCTION

C. Casing Length (ft) 23

Type Schedule 40 PVC

D. Casing Diameter (ft) 0.167

E. Depth to Top of Slotted Interval (ft) 13

F. Perforated Casing Length (ft) 10

Perforated Interval From 13 to 23 ft

Perforation Type Continuous Slot

Perforation Size 0.01"

G. Surface Grout Interval (ft) 0-9

Grout Material Portland Cement

H. Backfilled Interval (ft) NA

Backfill Material NA

I. Sealed Interval (ft) 9-11

Seal Material Bentonite Chips

J. Filter Pack Interval (ft) 11-23

Pack Material Silica Sand

K. Bottom Seal Interval (ft) NA

Seal Material NA

L. Depth to Top of Casing (in) _____

M. Protective Casing Diameter (in) _____

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TECHNOLOGIES INC

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Huntingdon Engineering & Environmental, Inc.

640 West Main Street
Lead, South Dakota 57754
(605)584-2007
Fax:(605)584-2007

2821 Plant Street
P.O. Box 6703, 57709-6703
Rapid City, South Dakota 57702-0335

Chemistry (605)341-7284
Engineering/Environmental (605)348-5850
Fax: (605)341-0868

Well Designation P-1 Development Technician T. Odell
Date Grouted 5-15-96
Date Development Started 5-16-96 Date development concluded 5-16-96
Length of Sandpack 12'
Depth of Well 25.11
Depth to Water 16.50 Depth to NAPL
Liquid Depth 8.61 x 0.16 = 1.4 (vol. of water in 2" PVC)
Liquid Depth 8.61 x 4.07 = 35.0 (vol. of water in 10" borehole)[1]
Vol. of water in 10" borehole (35) - vol. of water in 2" PVC (1.4) = 33.6 (vol. of annular space)

Vol. of annular space (33.6) x 0.30 = (10.1) (vol. of water held in sandpack)
Vol. of water in sandpack (10.1) + vol. of water in 2" PVC (1.4) = (11.5) (one well volume)

WELL VOLUME	GAL	TIME	pH	CONDUCTIVITY uMHOS	TEMP C.	TURBIDITY NTU
INITIAL	0	16:30	7.89	1150	15.3	>1000
1	11.5	16:55	7.81	1050	16.8	>1000
2	22.0	17:18	7.89	1050	15.4	>1000

COPY

Total number of gallons removed 22.0 Average pumping rate
Equipment used Bailer Number of drums generated
Comments:

[1] If the height of the sandpack is greater than the liquid depth, use the height of the sandpack to determine the vol. of the borehole.

Buckets: 1

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2821 Plant Street
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Engineering/Environmental (605)348-5850
Fax: (605)341-0868

Well Designation EW-2 Development Technician Justin Klitzke
Date Grouted 5-15-96
Date Development Started 5-16-96 Date development concluded 5-16-96
Length of Sandpack ~~15'~~ 11'
Depth of Well
Depth to Water 15.44' Depth to NAPL
Liquid Depth ____ x ____ = ____ (vol. of water in PVC)
Liquid Depth ____ x ____ = ____ (vol. of water in borehole)[1]
Vol. of water in borehole (____)- vol. of water in PVC (____) = ____ (vol. of annular space)

Vol. of annular space (____)x 0.30 = (____) (vol. of water held in sandpack)
Vol. of water in sandpack (____) + vol. of water in PVC (____) = (18.5) (one well volume)

WELL VOLUME	GAL	TIME	pH	CONDUCTIVITY uMHOS	TEMP C	TURBIDITY NTU	
INITIAL	0	13:48	~~8~~ 8.02	900	17.7	>1000	Surged & purged w Bailer
	4						Started Surging w/ Surge Blade
	10	~~14:00~~					Surged & purged w/ Bailer
	10	14:30					Started pumping w/Grundfos
	28						Pumped Dry
	28	15:09					Started pumping w/ Grundfos
		15:15	7.83	1200	16.8	>1000	
		15:19					
		15:22	7.98	1100	18.2	Clear	
		15:30	7.81	1050	12.8	Clear	
		15:50					Shut pump down Let well recover
		16:00	7.77	1058	13.2	Clear	Start pumping
		~~16:10~~					END
	175 gal Total						

400 gal/min
100 gal/min
130 gal/min
197 gallons
215

Total number of gallons removed 175 gal Average pumping rate
Equipment used Surged w/ Surge Block Number of drums generated
Comments: Bailed Grundfos Pump

COPY

[1] If the height of the sandpack is greater than the liquid depth, use the height of the sandpack to determine the vol. of the borehole.

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Well Designation P-2 Development Technician Justin Klitzke
Date Grouted 5-15-96
Date Development Started 5-16-96 Date development concluded 5-16-96
Length of Sandpack 12'
Depth of Well 25.11
Depth to Water 17.21 Depth to NAPL
Liquid Depth 7.9 x 0.16 = 1.26 (vol. of water in 2" PVC)
Liquid Depth 7.9 x 4.07 = 32.15 (vol. of water in 10" borehole)[1]
Vol. of water in 10" borehole (32.15) - vol. of water in 2" PVC (1.26) = 30.89 (vol. of annular space)

Vol. of annular space (30.89) x 0.30 = (9.27) (vol. of water held in sandpack)
Vol. of water in sandpack (9.27) + vol. of water in 2" PVC (1.26) = (10.53) (one well volume)

WELL VOLUME	GAL	TIME	pH	CONDUCTIVITY uMHOS	TEMP C	TURBIDITY NTU
INITIAL	0	15:01	7.92	900	18.0	>1000
	10.5	15:37	7.86	850	17.1	>1000
	21	16:07	7.82	1100	17.5	>1000
	31.5	16:40	7.89	1150	14.6	>1000

Total number of gallons removed 31.5 Average pumping rate
Equipment used Bailer Number of drums generated
Comments:

COPY

[1] If the height of the sandpack is greater than the liquid depth, use the height of the sandpack to determine the vol. of the borehole.

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$\pi r^2 = \pi(\frac{5}{12})^2 / 7.48$

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2" = 0.16
10" = 4.07
Sand Porosity = 0.3

Well Designation P-3 Development Technician VB ZMSH

Date Grouted _____

Date Development Started 5-16-96 Date development concluded 5-16-96

Length of Sandpack _____

Depth of Well 25.1

Depth to Water 15.75 Depth to NAPL _____

Liquid Depth 9.35 x 0.16 = 1.5 (vol. of water in 2" PVC)

Liquid Depth 9.35 x 4.07 = 38 (vol. of water in 10" borehole)[1]

Vol. of water in 10" borehole (38) - vol. of water in 2" PVC (1.5) = 36.5 (vol. of annular space)

Vol. of annular space (36.5) x 0.30 = (11) (vol. of water held in sandpack)

Vol. of water in sandpack (11) + vol. of water in 2" PVC (1.5) = (12.5) (one well volume)

WELL VOLUME	GAL	TIME	pH	CONDUCTIVITY uMHOS	TEMP C	TURBIDITY NTU
INITIAL	0	14:25	7.76	950	23.0	
	12.5 ~~15~~	1500	7.81	875	17.5	
	25.0	1535	7.90	1100	19.2	
	37.5	1625	7.86	1000	16.0	

Total number of gallons removed _____ Average pumping rate _____

Equipment used _____ Number of drums generated _____

Comments: _____

[1] If the height of the sandpack is greater than the liquid depth, use the height of the sandpack to determine the vol. of the borehole.

Page 1 of _____

CONTAINERIZED MATERIALS LOG

Project Ellsworth 2-Phase - BG-04 Plume

City Ellsworth AFB State South Dakota

Drum Number	Well or Boring Number	Material Type	Date Filed First	Date Filed Last	Location Moved to	Final Disposition	Signatures of Movers
1	EW-2	Soil	5/14	5/14/96			
2	EW-2	Soil	5/14	5/14/96			
3	EW-2	Soil	5/14	5/14/96			
4	EW-2	Decon. Water	5/15	5/15/96			
5	EW-2, P-2	Decon. Water	5/15	5/15/96			
6	EW-2	Decon. Water	5/14	5/15/96			
7	EW-2	Soil	5/15	5/15/96			
8	P-3	Soil	5/15	5/15/96			
9	P-2	Soil	5/15	5/15/96			
10	P-1	Soil	5/15	5/15/96			

APPENDIX B

Field Data Tables

BG-04 Site

Field Measurements Data Sheet

Date	Time	Water Level (ft below top of casing)					Piezometer Vacuum (in WC)			Weather		Comments
		Piezometers			Monitoring Wells (MW)					Temp	Baro.	
		P1	P2	P3	941148	93BG04	P1	P2	P3	(deg F)	(mb)	
5/19/96	15:35	18.02	18.77	17.22	13.79	28.33	0.0	0.00	0.00	65	898	Pre test readings
5/19/96	16:07											begin test 1-1/4" straw
5/19/96	16:20	18.46	18.97	17.23	-	-	1.5	0.50	0.31			
5/19/96	17:00	18.66	19.15	17.26			1.8	0.64	0.40			end 1-1/4" straw test
5/19/96	17:25	18.71	19.19	17.26			2.1	0.69	0.45	60	898	1-1/2" straw began @ 17:12
5/19/96	18:00	18.81	19.28	17.28			2.4	0.94	0.58			raining
5/19/96	21:35	18.96	19.45	17.37			2.6	0.92	0.60	55	900	light rain
5/20/96	7:25	19.12	19.61	17.52	13.8		2.7	1.00	0.70		902	
5/20/96	9:00	19.16	19.63	17.54			2.7	1.00	0.70	55		
5/20/96	11:45	19.15	19.65	17.57			3.3	1.30	0.79			very windy
5/20/96	14:40	19.16	19.66	17.58	13.8		3.6	1.30	0.72			
5/20/96	16:00	19.18	19.68	17.6			3.1	1.10	0.70	55	903	slight wind
5/21/96	8:00	19.16	19.69	17.68	13.81		3.4	1.30	0.79		907	slight wind
5/21/96	10:00	19.17	19.7	17.69			3.4	1.20	0.79	60		slight wind
5/21/96	10:30	19.19	19.7	17.7			3.3	1.30	0.78	65		2" straw size
5/21/96	13:00	19.18	19.71	17.7			3.3	1.10	0.73	70		
5/21/96	15:50	19.2	19.71	17.7	13.78	28.34	3.7	1.20	0.80			
5/21/96	21:30	19.18	19.71	17.72			3.5	1.30	0.80			
												Unit off from 4 AM to 8:30 AM
5/22/96	8:15	18.52	19.21	17.65								
5/22/96	8:40	18.98	19.42	17.63			4.1	1.30	0.86	55		Start up again
5/22/96	10:20	19.19	19.66	17.66			4.5	1.60	1.02			
5/22/96	13:20	19.24	19.76	17.7			4.5	1.60	1.05			
5/22/96	14:00	19.25	19.75	17.69			4.8	1.65	1.05			new well head 2" straw
5/22/96	16:30	19.29	19.82	17.74	13.76		4.95	1.75	1.10			
5/22/96	17:30	19.28	19.84	17.76			5	1.85	1.15			
5/23/96	9:10	19.27	19.86	17.81			4.85	1.85	1.25	50		Rain
5/23/96	16:15	19.28	19.9	17.84			5.6	2.70	1.90			
5/24/96	8:15	19.3	19.96	17.86			8.5	5.10	3.80			Rain
5/24/96	10:45	19.3	19.95	17.87			8.6	5.10	3.90	50		Rain
5/24/96	12:45	19.29	19.93	17.87			8.7	5.10	3.80			Rain
5/24/96	15:45	19.27	19.9	17.85			8.5	4.90	3.65			Rain
5/25/96	10:15	19.21	19.83	17.82			8.6	4.60	3.70	50		Mist
5/25/96	15:30	18.48	19.18	17.72								Post test readings
5/26/96	10:30	18.17	18.9	17.48								Post test readings

Ellsworth Air Force Base - Two (2) Phase Pilot Test (BG-04 Test)

2-PHASE System Operating Conditions Data Sheet

			System Inlet		Wellhead		Seal Fluid				Exhaust Vapor					
Date	Time	Total Operating Hours	Temp. (deg F)	Vacuum (in. Hg)	Top of Straw Vacuum (in. Hg)	Well Vacuum (in. Hg)	Temp. (deg F)	Pressure at Pump (psi)	Oil Potential Temp. (deg F)	Oil Potential Pressure (psi)	Temp. (deg F)	Pressure (psi)	Flow (cfm)	Aspir. Flow (cfm)	Totalizer Liquid Volume (gal)	Comments
5/19/96	16:07	2685													25833	Begin test
5/19/96	16:25	2685.4	40	26.0	19.0	10	160	1	163	18	66	1	10	2	25960	1-1/4" straw
5/19/96	17:07	2686.1	40	25.0	19.0	11	172	1	176	17	62	1	13.5	4	26104	
5/19/96	17:12															restart with 1-1/2" straw
5/19/96	17:27	2686.5	36	25.5	19.0	12	174	1	177	17	62	1.2	13	2	26190	
5/19/96	18:05	2687.1	36	25.0	19.0	12	174	1	176	17	58	1.5	14.5	2	26327	
5/19/96	21:40	2690.9	35	25.0	19.0	13	172	2	176	18	56	1	16	2	27015	
5/20/96	7:20	2700.7	36	24.5	19.0	13.5	170	1	176	18	56	2	17	2	28606	
5/20/96	9:10	2702.64	36	25.0	19.0	13.5	170	0	176	17	60	2	17	2	28903	changed vacuum gauges
5/20/96	11:55	2705.39	36	23.5	19.0	14	176	2	178	18	60	1	17.3	0	29349	
5/20/96	14:50	2708.34	36	23.5	19.3	13.8	176	1	178	17.5	60	1	17.3	0	29767	
5/20/96	16:00	2709.63	36	23.5	19.7	14	178	1	180	18	60	2	17.5	0	29950	
5/21/96	8:05	2726.12	36	23.5	19.5	14	172	1	176	17	58	2	18	0	32163	
5/21/96	10:05	2728.04	36	23.5	20.0	14	171	0	179	17	72	1	20	0	32422	
5/21/96	10:30	2728.61	36	23.8	20.0	13.5	172	1	179	16	74	1	20	0	32498	2" straw
5/21/96	13:00	2731.34	36	23.8	20.5	13.5	172	1	178	16	74	1	20	0	32830	
5/21/96	16:00	2734.13	36	23.5	20.0	13.5	171	1	177	16	74	1	20.5	0	33254	
5/21/96	21:30	2739.89	36	23.5	20.0	14	173	2	177	18	56	2	20	0	34001	
5/22/96	8:15	2745.5													34734	Unit off from 4 AM to 8:30 AM
5/22/96	8:30	2745.74	-													Restart
5/22/96	8:45	2746.01	-	23.0	15.5	9	157	2	174	21	53	0.5	24	0	34806	
5/22/96	10:25	2747.74		23.0	16.5	10.5	158	1	176	19	58	0.5	25	0	35161	
5/22/96	13:25	2750.85	-	23.0	17.5	11	168	1	176	18	68	0.5	26	0	35705	
5/22/96	14:05	2751.53	-	23.0	-	10	168	1	178	17	70	0.5	28	0	35792	New well head 2" straw
5/22/96	16:30	2754.05		23.0	-	10	170	1	176	18	64	0.5	30	0	36220	
5/22/96	17:30	2755.06	-	23.0	-	10	170	1	180	19	64	0.5	29	0	36388	
5/23/96	9:15	2771.11	-	23.0	-	12	160	1	176	21	50	2	27	0	38690	Rain
5/23/96	16:15	2778.28	-	22.5	-	12	158	1	176	21	50	2	28	0	39664	Rain
5/24/96	8:15	2794.85	-	23.0	-	12	160	1	176	21	50	2	28	0	41840	Rain
5/24/96	10:45	2797.36	-	23.0	-	13	162	1	176	21	50	1	27	0	42167	Rain
5/24/96	12:45	2799.64	-	23.0	-	13	158	1	176	21	50	2	28	0	42458	Rain
5/24/96	15:45	2802.52	-	23.0	-	13	162	1	176	21	50	1	28	0	42843	Rain
5/25/96	10:15	2821.64	-	23.0	-	12	163	1	175	20.5	44	1	28	0	45265	Mist
5/25/96	10:30	2821.83													45299	Stopped test

Ellsworth Air Force Base - Two (2) Phase Pilot Test (BG-04 Test)

Analytical Sampling Field Data Sheet

Date	Time	Extracted Liquid SW-8260/8015M	Extracted Vapor AM4.02	Liquid Duplicate SW-8260/8015M	Liquid Trip Blank SW-8260	Vapor Duplicate AM4.02	Vapor Trip Blank AM4.02	Groundwater SW-8260/8015M	Soil Vapor AM4.02	Liquid Phase Carbon Effluent (Storage Tank) SW-8260
5/16/96	17:00				X			EW-2 Pre Test		
5/19/96	14:40	Effluent disch #1	Vapor 1							
5/19/96	18:12	Effluent disch #2	Vapor 2							
5/20/96	7:35	Effluent disch #3	Vapor 3		X					
5/20/96	14:50	Effluent disch #4	Vapor 4							
5/21/96	8:15	Effluent disch #5	Vapor 5							
5/21/96	15:45	Effluent disch #6	Vapor 6							
5/22/96	10:00	Effluent disch #7	Vapor 7							
5/22/96	10:00	Effluent disch #7D	Vapor 7D	X		X				
5/22/96	16:00	Effluent disch #8	Vapor 8		X					
5/23/96	9:20	Effluent disch #9	Vapor 9							
5/23/96	16:15	Effluent disch #10	Vapor 10							
5/24/96	10:45	Effluent disch #11	Vapor 11		X					
5/24/96	15:45	Effluent disch #12	Vapor 12							
5/25/96	10:10	Effluent disch #13	Vapor 13							
5/25/96	11:10	EW-2 Post Test			X			EW-2 Post Test		

Analytical_data BGDAT695.XLS
3:26 PM 6/26/96

APPENDIX C

Groundwater Sample Analytical Data

ENERGY LABORATORIES, INC.
P.O. BOX 2470 • RAPID CITY, SD 57709 • PHONE (605) 342-1225
610 FARNWOOD STREET • RAPID CITY, SD 57701 • FAX (605) 342-1397

James Machin
Radian Corporation
P.O. Box 201088
Austin, TX 78720-1088

Ellsworth AFB, BG-04
Sampled: 05-19/20-96

June 4, 1996
96-23463-65
Submitted: 05-20-96

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

Water Analysis

BG-04 Effluent #1 96-23463 **8260 LONG** RH:05-31-96

Analysis	µg/L	POL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	3.3	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed
BG-04 Effluent #1		96-23463	**8260 LONG**				RH:05-31-96
					µg/L	PQL	
				1,2,3-Trichlorobenzene	<1.0	1.0	
				Acetone	<20	20	
				Methyl Ethyl Ketone	<10	10	
				Dichlorodifluoromethane	<1.0	1.0	
				Chloromethane	<1.0	1.0	
				Vinyl Chloride	<1.0	1.0	
				Bromomethane	<1.0	1.0	
				Chloroethane	<1.0	1.0	
				Trichlorofluoromethane	<1.0	1.0	
				2-Chloroethylvinylether	<1.0	1.0	
				Carbon Disulfide	<1.0	1.0	
				Vinyl Acetate	<1.0	1.0	
				Methyl Isobutyl Ketone	<10	10	
				2-Hexanone	<10	10	
				Acrolein	<10	10	
				Acrylonitrile	<10	10	
				Methyltertiary Butyl Ether	<1.0	1.0	
				Iodomethane	<1.0	1.0	
			Surrogate Recoveries				
				1,2-Dichloroethane-d4	101		% Recovery
				Toluene-d8	100		
				4-Bromofluorobenzene	103		

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed
BG-04 Effluent #2		96-23464	8260 LONG				RH:05-31-96

Analysis	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	2.9	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	100	% Recovery
Toluene-d8	104	
4-Bromofluorobenzene	102	

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

BG-04 Effluent #3 **8260 LONG** RH:05-31-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	2.5	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	109	% Recovery
Toluene-d8	100	
4-Bromofluorobenzene	102	

Kurt R. Slentz
Laboratory Manager

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Method Blank **8260 LONG** RH:05-31-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M + P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	92	% Recovery
Toluene-d8	108	
4-Bromofluorobenzene	107	

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Trip Blank **8260 LONG** RH:05-31-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	89	% Recovery
Toluene-d8	107	
4-Bromofluorobenzene	109	

ENERGY LABORATORIES, INC.
P.O. BOX 2470 • RAPID CITY, SD 57709 • PHONE (605) 342-1225
610 FARNWOOD STREET • RAPID CITY, SD 57701 • FAX (605) 342-1397

James Machin
Radian Corporation
P.O. Box 201088
Austin, TX 78720-1088

Ellsworth AFB
BG-04
Sampled: 05-20/21/22-96

June 5, 1996
96-23546-51
Submitted: 05-23-96

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

Water Analysis

BG-04 Effluent #4 96-23546 8260 LONG RH:05-31-96

Analysis	Results	Units	PQL
1,1-Dichloroethene	<1.0	µg/L	1.0
Methylene Chloride	<1.0		1.0
trans-1,2-Dichloroethene	<1.0		1.0
1,1-Dichloroethane	<1.0		1.0
2,2-Dichloropropane	<1.0		1.0
cis-1,2-Dichloroethene	<1.0		1.0
Bromochloromethane	<1.0		1.0
Chloroform	<1.0		1.0
1,1,1-Trichloroethane	<1.0		1.0
Carbon Tetrachloride	<1.0		1.0
1,1-Dichloropropene	<1.0		1.0
Benzene	<1.0		1.0
1,2-Dichloroethane	<1.0		1.0
Trichloroethene	2.5		1.0
1,2-Dichloropropane	<1.0		1.0
Dibromomethane	<1.0		1.0
Bromodichloromethane	<1.0		1.0
Trans-1,3-Dichloropropene	<1.0		1.0
Toluene	<1.0		1.0
cis-1,3-Dichloropropene	<1.0		1.0
1,1,2-Trichloroethane	<1.0		1.0
Tetrachloroethene	<1.0		1.0
1,3-Dichloropropane	<1.0		1.0
Dibromochloromethane	<1.0		1.0
1,2-Dibromoethane	<1.0		1.0
Chlorobenzene	<1.0		1.0
1,1,1,2-Tetrachloroethane	<1.0		1.0
Ethylbenzene	<1.0		1.0
M+P Xylenes	<1.0		1.0
O-Xylene	<1.0		1.0
Styrene	<1.0		1.0
Bromoform	<1.0		1.0
Isopropylbenzene	<1.0		1.0
Bromobenzene	<1.0		1.0
1,1,2,2-Tetrachloroethane	<1.0		1.0
1,2,3-Trichloropropane	<1.0		1.0
n-Propylbenzene	<1.0		1.0
2-Chlorotoluene	<1.0		1.0
4-Chlorotoluene	<1.0		1.0
1,3,5-Trimethylbenzene	<1.0		1.0
tert-Butylbenzene	<1.0		1.0
1,2,4-Trimethylbenzene	<1.0		1.0
sec-Butylbenzene	<1.0		1.0
1,3-Dichlorobenzene	<1.0		1.0
1,4-Dichlorobenzene	<1.0		1.0
p-Isopropyltoluene	<1.0		1.0
1,2-Dichlorobenzene	<1.0		1.0
n-Butylbenzene	<1.0		1.0
1,2-Dibromo-3-Chloropropane	<1.0		1.0
1,2,4-Trichlorobenzene	<1.0		1.0
Naphthalene	<1.0		1.0
Hexachlorobutadiene	<1.0		1.0

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed
BG-04 Effluent #4		96-23546	8260 LONG				RH:05-31-96
					µg/L	PQL	
				1,2,3-Trichlorobenzene	<1.0	1.0	
				Acetone	<20	20	
				Methyl Ethyl Ketone	<10	10	
				Dichlorodifluoromethane	<1.0	1.0	
				Chloromethane	<1.0	1.0	
				Vinyl Chloride	<1.0	1.0	
				Bromomethane	<1.0	1.0	
				Chloroethane	<1.0	1.0	
				Trichlorofluoromethane	<1.0	1.0	
				2-Chloroethylvinylether	<1.0	1.0	
				Carbon Disulfide	<1.0	1.0	
				Vinyl Acetate	<1.0	1.0	
				Methyl Isobutyl Ketone	<10	10	
				2-Hexanone	<10	10	
				Acrolein	<10	10	
				Acrylonitrile	<10	10	
				Methyltertiary Butyl Ether	<1.0	1.0	
				Iodomethane	<1.0	1.0	
			Surrogate Recoveries				
				1,2-Dichloroethane-d4	99		% Recovery
				Toluene-d8	105		
				4-Bromofluorobenzene	103		

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed
BG-04 Effluent #5		96-23547	8260 LONG				RH:06-03-96
					µg/L	PQL	
				1,1-Dichloroethene	<1.0	1.0	
				Methylene Chloride	<1.0	1.0	
				trans-1,2-Dichloroethene	<1.0	1.0	
				1,1-Dichloroethane	<1.0	1.0	
				2,2-Dichloropropane	<1.0	1.0	
				cis-1,2-Dichloroethene	<1.0	1.0	
				Bromochloromethane	<1.0	1.0	
				Chloroform	<1.0	1.0	
				1,1,1-Trichloroethane	<1.0	1.0	
				Carbon Tetrachloride	<1.0	1.0	
				1,1-Dichloropropene	<1.0	1.0	
				Benzene	<1.0	1.0	
				1,2-Dichloroethane	<1.0	1.0	
				Trichloroethene	2.0	1.0	
				1,2-Dichloropropane	<1.0	1.0	
				Dibromomethane	<1.0	1.0	
				Bromodichloromethane	<1.0	1.0	
				Trans-1,3-Dichloropropene	<1.0	1.0	
				Toluene	<1.0	1.0	
				cis-1,3-Dichloropropene	<1.0	1.0	
				1,1,2-Trichloroethane	<1.0	1.0	
				Tetrachloroethene	<1.0	1.0	
				1,3-Dichloropropane	<1.0	1.0	
				Dibromochloromethane	<1.0	1.0	
				1,2-Dibromoethane	<1.0	1.0	
				Chlorobenzene	<1.0	1.0	
				1,1,1,2-Tetrachloroethane	<1.0	1.0	
				Ethylbenzene	<1.0	1.0	
				M+P Xylenes	<1.0	1.0	
				O-Xylene	<1.0	1.0	
				Styrene	<1.0	1.0	
				Bromoform	<1.0	1.0	
				Isopropylbenzene	<1.0	1.0	
				Bromobenzene	<1.0	1.0	
				1,1,2,2-Tetrachloroethane	<1.0	1.0	
				1,2,3-Trichloropropane	<1.0	1.0	
				n-Propylbenzene	<1.0	1.0	
				2-Chlorotoluene	<1.0	1.0	
				4-Chlorotoluene	<1.0	1.0	
				1,3,5-Trimethylbenzene	<1.0	1.0	
				tert-Butylbenzene	<1.0	1.0	
				1,2,4-Trimethylbenzene	<1.0	1.0	
				sec-Butylbenzene	<1.0	1.0	
				1,3-Dichlorobenzene	<1.0	1.0	
				1,4-Dichlorobenzene	<1.0	1.0	
				p-Isopropyltoluene	<1.0	1.0	
				1,2-Dichlorobenzene	<1.0	1.0	
				n-Butylbenzene	<1.0	1.0	
				1,2-Dibromo-3-Chloropropane	<1.0	1.0	
				1,2,4-Trichlorobenzene	<1.0	1.0	
				Naphthalene	<1.0	1.0	
				Hexachlorobutadiene	<1.0	1.0	
				1,2,3-Trichlorobenzene	<1.0	1.0	
				Acetone	<20	20	
				Methyl Ethyl Ketone	<10	10	
				Dichlorodifluoromethane	<1.0	1.0	
				Chloromethane	<1.0	1.0	
				Vinyl Chloride	<1.0	1.0	
				Bromomethane	<1.0	1.0	
				Chloroethane	<1.0	1.0	
				Trichlorofluoromethane	<1.0	1.0	
				2-Chloroethylvinylether	<1.0	1.0	
				Carbon Disulfide	<1.0	1.0	
				Vinyl Acetate	<1.0	1.0	
				Methyl Isobutyl Ketone	<10	10	
				2-Hexanone	<10	10	
				Acrolein	<10	10	
				Acrylonitrile	<10	10	
				Methyltertiary Butyl Ether	<1.0	1.0	
				Iodomethane	<1.0	1.0	
			Surrogate Recoveries				
				1,2-Dichloroethane-d4	98		% Recovery
				Toluene-d8	103		
				4-Bromofluorobenzene	103		

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed
BG-04 Effluent #6		96-23548	8260 LONG				RH:06-03-96
					µg/L	PQL	
				1,1-Dichloroethene	<1.0	1.0	
				Methylene Chloride	<1.0	1.0	
				trans-1,2-Dichloroethene	<1.0	1.0	
				1,1-Dichloroethane	<1.0	1.0	
				2,2-Dichloropropane	<1.0	1.0	
				cis-1,2-Dichloroethene	<1.0	1.0	
				Bromochloromethane	<1.0	1.0	
				Chloroform	<1.0	1.0	
				1,1,1-Trichloroethane	<1.0	1.0	
				Carbon Tetrachloride	<1.0	1.0	
				1,1-Dichloropropene	<1.0	1.0	
				Benzene	<1.0	1.0	
				1,2-Dichloroethane	<1.0	1.0	
				Trichloroethene	2.0	1.0	
				1,2-Dichloropropane	<1.0	1.0	
				Dibromomethane	<1.0	1.0	
				Bromodichloromethane	<1.0	1.0	
				Trans-1,3-Dichloropropene	<1.0	1.0	
				Toluene	<1.0	1.0	
				cis-1,3-Dichloropropene	<1.0	1.0	
				1,1,2-Trichloroethane	<1.0	1.0	
				Tetrachloroethene	<1.0	1.0	
				1,3-Dichloropropane	<1.0	1.0	
				Dibromochloromethane	<1.0	1.0	
				1,2-Dibromoethane	<1.0	1.0	
				Chlorobenzene	<1.0	1.0	
				1,1,1,2-Tetrachloroethane	<1.0	1.0	
				Ethylbenzene	<1.0	1.0	
				M+P Xylenes	<1.0	1.0	
				O-Xylene	<1.0	1.0	
				Styrene	<1.0	1.0	
				Bromoform	<1.0	1.0	
				Isopropylbenzene	<1.0	1.0	
				Bromobenzene	<1.0	1.0	
				1,1,2,2-Tetrachloroethane	<1.0	1.0	
				1,2,3-Trichloropropane	<1.0	1.0	
				n-Propylbenzene	<1.0	1.0	
				2-Chlorotoluene	<1.0	1.0	
				4-Chlorotoluene	<1.0	1.0	
				1,3,5-Trimethylbenzene	<1.0	1.0	
				tert-Butylbenzene	<1.0	1.0	
				1,2,4-Trimethylbenzene	<1.0	1.0	
				sec-Butylbenzene	<1.0	1.0	
				1,3-Dichlorobenzene	<1.0	1.0	
				1,4-Dichlorobenzene	<1.0	1.0	
				p-Isopropyltoluene	<1.0	1.0	
				1,2-Dichlorobenzene	<1.0	1.0	
				n-Butylbenzene	<1.0	1.0	
				1,2-Dibromo-3-Chloropropane	<1.0	1.0	
				1,2,4-Trichlorobenzene	<1.0	1.0	
				Naphthalene	<1.0	1.0	
				Hexachlorobutadiene	<1.0	1.0	
				1,2,3-Trichlorobenzene	<1.0	1.0	
				Acetone	<20	20	
				Methyl Ethyl Ketone	<10	10	
				Dichlorodifluoromethane	<1.0	1.0	
				Chloromethane	<1.0	1.0	
				Vinyl Chloride	<1.0	1.0	
				Bromomethane	<1.0	1.0	
				Chloroethane	<1.0	1.0	
				Trichlorofluoromethane	<1.0	1.0	
				2-Chloroethylvinylether	<1.0	1.0	
				Carbon Disulfide	<1.0	1.0	
				Vinyl Acetate	<1.0	1.0	
				Methyl Isobutyl Ketone	<10	10	
				2-Hexanone	<10	10	
				Acrolein	<10	10	
				Acrylonitrile	<10	10	
				Methyltertiary Butyl Ether	<1.0	1.0	
				Iodomethane	<1.0	1.0	
			Surrogate Recoveries				
				1,2-Dichloroethane-d4	101		% Recovery
				Toluene-d8	98		
				4-Bromofluorobenzene	96		

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed
BG-04 Effluent #7		96-23549	8260 LONG				RH:06-03-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	2.5	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	102	% Recovery
Toluene-d8	99	
4-Bromofluorobenzene	99	

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

BG-04 Effluent #7 Duplicate | 96-23550 | 8260 LONG | RH:06-03-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	2.5	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	100	% Recovery
Toluene-d8	97	
4-Bromofluorobenzene	98	

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed
BG-04 Effluent #8		96-23551	8260 LONG				RH:06-03-96

Analysis	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	2.5	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	105	% Recovery
Toluene-d8	102	
4-Bromofluorobenzene	96	

Kurt R. Slentz
Laboratory Manager

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Method Blank **8260 LONG** RH:06-03-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	98	% Recovery
Toluene-d8	104	
4-Bromofluorobenzene	98	

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Trip Blank

8260 LONG

RH:06-04-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	85	% Recovery
Toluene-d8	109	
4-Bromofluorobenzene	107	

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

VOLATILE ORGANIC COMPOUNDS
QUALITY ASSURANCE REPORT FORM

SAMPLE LOT 96-23551
SAMPLE MATRIX Water
EXTRACTION DATE na
ANALYST RH

MATRIX SPIKE / MATRIX SPIKE DUPLICATE DATA

Compound	Spike Added (µg)/L	Sample (µg)	Matrix Spike (µg)	Matrix Spike % Rec	Matrix Spike Duplicate (µg)	Matrix Spike Duplicate % Rec	% Difference $\left(\frac{\text{Difference}}{\text{Average}}\right)$	QC Limits
1,1-Dichloroethene	5.0	<1.0	5.2	104	5.0	100	3.9	60-140%
Benzene	5.0	<1.0	5.2	104	5.2	104	0	60-140%
Trichloroethene	5.0	2.5	7.8	106	7.7	104	1.9	60-140%
Toluene	5.0	<1.0	5.5	110	5.3	106	3.7	60-140%
Chlorobenzene	5.0	<1.0	5.7	114	5.6	112	1.8	60-140%

ENERGY LABORATORIES, INC.
P.O. BOX 2470 • RAPID CITY, SD 57709 • PHONE (605) 342-1225
610 FARNWOOD STREET • RAPID CITY, SD 57701 • FAX (605) 342-1397

James Machin
Radian Corporation
P.O. Box 201088
Austin, TX 78720-1088

Ellsworth AFB, BG-04
Sampled: 05-23/24-96

June 5, 1996
96-23588-90
Submitted: 05-24-96

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

Water Analysis

Effluent #9 96-23588 8260 LONG

RH:06-03-96

Analysis	Results (µg/L)	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	2.2	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed
Effluent #9 cont.		96-23588	8260 LONG				RH:06-03-96
					µg/L	PQL	
				1,2,3-Trichlorobenzene	<1.0	1.0	
				Acetone	<20	20	
				Methyl Ethyl Ketone	<10	10	
				Dichlorodifluoromethane	<1.0	1.0	
				Chloromethane	<1.0	1.0	
				Vinyl Chloride	<1.0	1.0	
				Bromomethane	<1.0	1.0	
				Chloroethane	<1.0	1.0	
				Trichlorofluoromethane	<1.0	1.0	
				2-Chloroethylvinylether	<1.0	1.0	
				Carbon Disulfide	<1.0	1.0	
				Vinyl Acetate	<1.0	1.0	
				Methyl Isobutyl Ketone	<10	10	
				2-Hexanone	<10	10	
				Acrolein	<10	10	
				Acrylonitrile	<10	10	
				Methyltertiary Butyl Ether	<1.0	1.0	
				Iodomethane	<1.0	1.0	
			Surrogate Recoveries				
				1,2-Dichloroethane-d4	103		% Recovery
				Toluene-d8	101		
				4-Bromofluorobenzene	98		

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

Effluent #10 96-23589 8260 LONG RH:06-03-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	2.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	102	% Recovery
Toluene-d8	97	
4-Bromofluorobenzene	98	

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

Effluent #11 — 96-23590 — 8260 LONG — RH:06-03-96

Analysis	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	2.2	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	104	% Recovery
Toluene-d8	102	
4-Bromofluorobenzene	97	

Kurt R. Slentz
Laboratory Manager

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Method Blank

8260 LONG

RH:06-03-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	98	% Recovery
Toluene-d8	104	
4-Bromofluorobenzene	98	

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Trip Blank **8260 LONG** RH:06-03-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	102	% Recovery
Toluene-d8	100	
4-Bromofluorobenzene	97	

ENERGY LABORATORIES, INC.
P.O. BOX 2470 • RAPID CITY, SD 57709 • PHONE (605) 342-1225
610 FARNWOOD STREET • RAPID CITY, SD 57701 • FAX (605) 342-1397

James Machin
Radian Corporation
P.O. Box 201088
Austin, TX 78720-1088

Ellsworth AFB
BG-04, EW-2
Sampled: 05-24/25-96

June 5, 1996
96-23601-03
Submitted: 05-28-96

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

Water Analysis

BG-04 Effluent #12 96-23601 8260 LONG

RH:06-03-96

Analysis	Results	Units	PQL
		µg/L	
1,1-Dichloroethene	<1.0		1.0
Methylene Chloride	<1.0		1.0
trans-1,2-Dichloroethene	<1.0		1.0
1,1-Dichloroethane	<1.0		1.0
2,2-Dichloropropane	<1.0		1.0
cis-1,2-Dichloroethene	<1.0		1.0
Bromochloromethane	<1.0		1.0
Chloroform	<1.0		1.0
1,1,1-Trichloroethane	<1.0		1.0
Carbon Tetrachloride	<1.0		1.0
1,1-Dichloropropene	<1.0		1.0
Benzene	<1.0		1.0
1,2-Dichloroethane	<1.0		1.0
Trichloroethene	2.1		1.0
1,2-Dichloropropane	<1.0		1.0
Dibromomethane	<1.0		1.0
Bromodichloromethane	<1.0		1.0
Trans-1,3-Dichloropropene	<1.0		1.0
Toluene	<1.0		1.0
cis-1,3-Dichloropropene	<1.0		1.0
1,1,2-Trichloroethane	<1.0		1.0
Tetrachloroethene	<1.0		1.0
1,3-Dichloropropane	<1.0		1.0
Dibromochloromethane	<1.0		1.0
1,2-Dibromoethane	<1.0		1.0
Chlorobenzene	<1.0		1.0
1,1,1,2-Tetrachloroethane	<1.0		1.0
Ethylbenzene	<1.0		1.0
M+P Xylenes	<1.0		1.0
O-Xylene	<1.0		1.0
Styrene	<1.0		1.0
Bromoform	<1.0		1.0
Isopropylbenzene	<1.0		1.0
Bromobenzene	<1.0		1.0
1,1,2,2-Tetrachloroethane	<1.0		1.0
1,2,3-Trichloropropane	<1.0		1.0
n-Propylbenzene	<1.0		1.0
2-Chlorotoluene	<1.0		1.0
4-Chlorotoluene	<1.0		1.0
1,3,5-Trimethylbenzene	<1.0		1.0
tert-Butylbenzene	<1.0		1.0
1,2,4-Trimethylbenzene	<1.0		1.0
sec-Butylbenzene	<1.0		1.0
1,3-Dichlorobenzene	<1.0		1.0
1,4-Dichlorobenzene	<1.0		1.0
p-Isopropyltoluene	<1.0		1.0
1,2-Dichlorobenzene	<1.0		1.0
n-Butylbenzene	<1.0		1.0
1,2-Dibromo-3-Chloropropane	<1.0		1.0
1,2,4-Trichlorobenzene	<1.0		1.0
Naphthalene	<1.0		1.0
Hexachlorobutadiene	<1.0		1.0

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed
BG-04 Effluent #12		96-23601	8260 LONG				RH:06-03-96
					µg/L	PQL	
				1,2,3-Trichlorobenzene	<1.0	1.0	
				Acetone	<20	20	
				Methyl Ethyl Ketone	<10	10	
				Dichlorodifluoromethane	<1.0	1.0	
				Chloromethane	<1.0	1.0	
				Vinyl Chloride	<1.0	1.0	
				Bromomethane	<1.0	1.0	
				Chloroethane	<1.0	1.0	
				Trichlorofluoromethane	<1.0	1.0	
				2-Chloroethylvinylether	<1.0	1.0	
				Carbon Disulfide	<1.0	1.0	
				Vinyl Acetate	<1.0	1.0	
				Methyl Isobutyl Ketone	<10	10	
				2-Hexanone	<10	10	
				Acrolein	<10	10	
				Acrylonitrile	<10	10	
				Methyltertiary Butyl Ether	<1.0	1.0	
				Iodomethane	<1.0	1.0	
			Surrogate Recoveries				
				1,2-Dichloroethane-d4	102		% Recovery
				Toluene-d8	99		
				4-Bromofluorobenzene	95		

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed
BG-04 Effluent #13		96-23602	8260 LONG				RH:06-03-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	2.2	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	103	% Recovery
Toluene-d8	98	
4-Bromofluorobenzene	96	

Site	Depth	Lab No.	Methodology	Analysis	Results		Units	Analyzed
EW-2 Post Test		96-23603	8260 LONG					RH:06-03-96
				1,1-Dichloroethene	<1.0		µg/L	PQL 1.0
				Methylene Chloride	<1.0			1.0
				trans-1,2-Dichloroethene	<1.0			1.0
				1,1-Dichloroethane	<1.0			1.0
				2,2-Dichloropropane	<1.0			1.0
				cis-1,2-Dichloroethene	<1.0			1.0
				Bromochloromethane	<1.0			1.0
				Chloroform	<1.0			1.0
				1,1,1-Trichloroethane	<1.0			1.0
				Carbon Tetrachloride	<1.0			1.0
				1,1-Dichloropropene	<1.0			1.0
				Benzene	<1.0			1.0
				1,2-Dichloroethane	<1.0			1.0
				Trichloroethene	36	(1)		1.0
				1,2-Dichloropropane	<1.0			1.0
				Dibromomethane	<1.0			1.0
				Bromodichloromethane	<1.0			1.0
				Trans-1,3-Dichloropropene	<1.0			1.0
				Toluene	<1.0			1.0
				cis-1,3-Dichloropropene	<1.0			1.0
				1,1,2-Trichloroethane	<1.0			1.0
				Tetrachloroethene	<1.0			1.0
				1,3-Dichloropropane	<1.0			1.0
				Dibromochloromethane	<1.0			1.0
				1,2-Dibromoethane	<1.0			1.0
				Chlorobenzene	<1.0			1.0
				1,1,1,2-Tetrachloroethane	<1.0			1.0
				Ethylbenzene	<1.0			1.0
				M+P Xylenes	<1.0			1.0
				O-Xylene	<1.0			1.0
				Styrene	<1.0			1.0
				Bromoform	<1.0			1.0
				Isopropylbenzene	<1.0			1.0
				Bromobenzene	<1.0			1.0
				1,1,2,2-Tetrachloroethane	<1.0			1.0
				1,2,3-Trichloropropane	<1.0			1.0
				n-Propylbenzene	<1.0			1.0
				2-Chlorotoluene	<1.0			1.0
				4-Chlorotoluene	<1.0			1.0
				1,3,5-Trimethylbenzene	<1.0			1.0
				tert-Butylbenzene	<1.0			1.0
				1,2,4-Trimethylbenzene	<1.0			1.0
				sec-Butylbenzene	<1.0			1.0
				1,3-Dichlorobenzene	<1.0			1.0
				1,4-Dichlorobenzene	<1.0			1.0
				p-Isopropyltoluene	<1.0			1.0
				1,2-Dichlorobenzene	<1.0			1.0
				n-Butylbenzene	<1.0			1.0
				1,2-Dibromo-3-Chloropropane	<1.0			1.0
				1,2,4-Trichlorobenzene	<1.0			1.0
				Naphthalene	<1.0			1.0
				Hexachlorobutadiene	<1.0			1.0
				1,2,3-Trichlorobenzene	<1.0			1.0
				Acetone	<20			20
				Methyl Ethyl Ketone	<10			10
				Dichlorodifluoromethane	<1.0			1.0
				Chloromethane	<1.0			1.0
				Vinyl Chloride	<1.0			1.0
				Bromomethane	<1.0			1.0
				Chloroethane	<1.0			1.0
				Trichlorofluoromethane	<1.0			1.0
				2-Chloroethylvinylether	<1.0			1.0
				Carbon Disulfide	<1.0			1.0
				Vinyl Acetate	<1.0			1.0
				Methyl Isobutyl Ketone	<10			10
				2-Hexanone	<10			10
				Acrolein	<10			10
				Acrylonitrile	<10			10
				Methyltertiary Butyl Ether	<1.0			1.0
				Iodomethane	<1.0			1.0
			Surrogate Recoveries					
				1,2-Dichloroethane-d4	100			% Recovery
				Toluene-d8	105			
				4-Bromofluorobenzene	94			

(1)-Value derived from a 10x dilution.

Kurt R. Slentz
Laboratory Manager

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Method Blank **8260 LONG** RH:06-03-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	98	% Recovery
Toluene-d8	104	
4-Bromofluorobenzene	98	

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Trip Blank **8260 LONG** RH:06-03-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	105	% Recovery
Toluene-d8	106	
4-Bromofluorobenzene	100	

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

VOLATILE ORGANIC COMPOUNDS
QUALITY ASSURANCE REPORT FORM

SAMPLE LOT 96-23602
SAMPLE MATRIX Water
EXTRACTION DATE na
ANALYST RH

MATRIX SPIKE / MATRIX SPIKE DUPLICATE DATA

Compound	Spike Added (µg)/L	Sample (µg)	Matrix Spike (µg)	Matrix Spike % Rec	Matrix Spike Duplicate (µg)	Matrix Spike Duplicate % Rec	% Difference $\left(\frac{\text{Difference}}{\text{Average}}\right)$	QC Limits
1,1-Dichloroethene	5.0	<1.0	5.0	100	5.4	108	7.7	60-140%
Benzene	5.0	<1.0	5.1	102	5.7	114	11.1	60-140%
Trichloroethene	5.0	2.2	7.5	106	7.7	110	3.7	60-140%
Toluene	5.0	<1.0	5.5	110	5.8	116	5.3	60-140%
Chlorobenzene	5.0	<1.0	5.8	116	6.2	124	6.7	60-140%

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

EW-1B Post Test 96-23375 8260 LONG RH:05-20-96

Analysis	µg/L	PQL
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	25	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	101	% Recovery
Toluene-d8	100	
4-Bromofluorobenzene	105	

(1)-Value derived from a 50x dilution.

EW-2 Pre Test 96-23376 8260 LONG RH:05-17-96

Analysis	µg/L	PQL
1,1-Dichloroethene	<2.0	2.0
Methylene Chloride	<2.0	2.0
trans-1,2-Dichloroethene	<2.0	2.0
1,1-Dichloroethane	<2.0	2.0
2,2-Dichloropropane	<2.0	2.0
cis-1,2-Dichloroethene	<2.0	2.0
Bromochloromethane	<2.0	2.0
Chloroform	<2.0	2.0
1,1,1-Trichloroethane	<2.0	2.0
Carbon Tetrachloride	<2.0	2.0
1,1-Dichloropropene	<2.0	2.0
Benzene	<2.0	2.0
1,2-Dichloroethane	<2.0	2.0

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

EW-2 Pre Test 96-23376 8260 LONG RH:05-17-96

	µg/L		PQL
Trichloroethene	45	(1)	2.0
1,2-Dichloropropane	<2.0		2.0
Dibromomethane	<2.0		2.0
Bromodichloromethane	<2.0		2.0
Trans-1,3-Dichloropropene	<2.0		2.0
Toluene	<2.0		2.0
cis-1,3-Dichloropropene	<2.0		2.0
1,1,2-Trichloroethane	<2.0		2.0
Tetrachloroethene	<2.0		2.0
1,3-Dichloropropane	<2.0		2.0
Dibromochloromethane	<2.0		2.0
1,2-Dibromoethane	<2.0		2.0
Chlorobenzene	<2.0		2.0
1,1,1,2-Tetrachloroethane	<2.0		2.0
Ethylbenzene	<2.0		2.0
M+P Xylenes	<2.0		2.0
O-Xylene	<2.0		2.0
Styrene	<2.0		2.0
Bromoform	<2.0		2.0
Isopropylbenzene	<2.0		2.0
Bromobenzene	<2.0		2.0
1,1,2,2-Tetrachloroethane	<2.0		2.0
1,2,3-Trichloropropane	<2.0		2.0
n-Propylbenzene	<2.0		2.0
2-Chlorotoluene	<2.0		2.0
4-Chlorotoluene	<2.0		2.0
1,3,5-Trimethylbenzene	<2.0		2.0
tert-Butylbenzene	<2.0		2.0
1,2,4-Trimethylbenzene	<2.0		2.0
sec-Butylbenzene	<2.0		2.0
1,3-Dichlorobenzene	<2.0		2.0
1,4-Dichlorobenzene	<2.0		2.0
p-Isopropyltoluene	<2.0		2.0
1,2-Dichlorobenzene	<2.0		2.0
n-Butylbenzene	<2.0		2.0
1,2-Dibromo-3-Chloropropane	<2.0		2.0
1,2,4-Trichlorobenzene	<2.0		2.0
Naphthalene	<2.0		2.0
Hexachlorobutadiene	<2.0		2.0
1,2,3-Trichlorobenzene	<2.0		2.0
Acetone	<40		20
Methyl Ethyl Ketone	<20		20
Dichlorodifluoromethane	<2.0		2.0
Chloromethane	<2.0		2.0
Vinyl Chloride	<2.0		2.0
Bromomethane	<2.0		2.0
Chloroethane	<2.0		2.0
Trichlorofluoromethane	<2.0		2.0
2-Chloroethylvinylether	<2.0		2.0
Carbon Disulfide	<2.0		2.0
Vinyl Acetate	<2.0		2.0
Methyl Isobutyl Ketone	<20		20
2-Hexanone	<20		20
Acrolein	<20		20
Acrylonitrile	<20		20
Methyltertiary Butyl Ether	<2.0		2.0
Iodomethane	<2.0		2.0

Surrogate Recoveries

1,2-Dichloroethane-d4	111	% Recovery
Toluene-d8	114	
4-Bromofluorobenzene	107	

(1)-Value derived from a 5x dilution.

Kurt R. Slentz
Laboratory Manager

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Method Blank — **8260 LONG**

RH:05-17-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	111	% Recovery
Toluene-d8	113	
4-Bromofluorobenzene	106	

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Method Blank	8260 LONG		µg/L	PQL	RH:05-20-96	
		1,1-Dichloroethene	<1.0	1.0		
		Methylene Chloride	<1.0	1.0		
		trans-1,2-Dichloroethene	<1.0	1.0		
		1,1-Dichloroethane	<1.0	1.0		
		2,2-Dichloropropane	<1.0	1.0		
		cis-1,2-Dichloroethene	<1.0	1.0		
		Bromochloromethane	<1.0	1.0		
		Chloroform	<1.0	1.0		
		1,1,1-Trichloroethane	<1.0	1.0		
		Carbon Tetrachloride	<1.0	1.0		
		1,1-Dichloropropene	<1.0	1.0		
		Benzene	<1.0	1.0		
		1,2-Dichloroethane	<1.0	1.0		
		Trichloroethene	<1.0	1.0		
		1,2-Dichloropropane	<1.0	1.0		
		Dibromomethane	<1.0	1.0		
		Bromodichloromethane	<1.0	1.0		
		Trans-1,3-Dichloropropene	<1.0	1.0		
		Toluene	<1.0	1.0		
		cis-1,3-Dichloropropene	<1.0	1.0		
		1,1,2-Trichloroethane	<1.0	1.0		
		Tetrachloroethene	<1.0	1.0		
		1,3-Dichloropropane	<1.0	1.0		
		Dibromochloromethane	<1.0	1.0		
		1,2-Dibromoethane	<1.0	1.0		
		Chlorobenzene	<1.0	1.0		
		1,1,1,2-Tetrachloroethane	<1.0	1.0		
		Ethylbenzene	<1.0	1.0		
		M+P Xylenes	<1.0	1.0		
		O-Xylene	<1.0	1.0		
		Styrene	<1.0	1.0		
		Bromoform	<1.0	1.0		
		Isopropylbenzene	<1.0	1.0		
		Bromobenzene	<1.0	1.0		
		1,1,2,2-Tetrachloroethane	<1.0	1.0		
		1,2,3-Trichloropropane	<1.0	1.0		
		n-Propylbenzene	<1.0	1.0		
		2-Chlorotoluene	<1.0	1.0		
		4-Chlorotoluene	<1.0	1.0		
		1,3,5-Trimethylbenzene	<1.0	1.0		
		tert-Butylbenzene	<1.0	1.0		
		1,2,4-Trimethylbenzene	<1.0	1.0		
		sec-Butylbenzene	<1.0	1.0		
		1,3-Dichlorobenzene	<1.0	1.0		
		1,4-Dichlorobenzene	<1.0	1.0		
		p-Isopropyltoluene	<1.0	1.0		
		1,2-Dichlorobenzene	<1.0	1.0		
		n-Butylbenzene	<1.0	1.0		
		1,2-Dibromo-3-Chloropropane	<1.0	1.0		
		1,2,4-Trichlorobenzene	<1.0	1.0		
		Naphthalene	<1.0	1.0		
		Hexachlorobutadiene	<1.0	1.0		
		1,2,3-Trichlorobenzene	<1.0	1.0		
		Acetone	<20	20		
		Methyl Ethyl Ketone	<10	10		
		Dichlorodifluoromethane	<1.0	1.0		
		Chloromethane	<1.0	1.0		
		Vinyl Chloride	<1.0	1.0		
		Bromomethane	<1.0	1.0		
		Chloroethane	<1.0	1.0		
		Trichlorofluoromethane	<1.0	1.0		
		2-Chloroethylvinylether	<1.0	1.0		
		Carbon Disulfide	<1.0	1.0		
		Vinyl Acetate	<1.0	1.0		
		Methyl Isobutyl Ketone	<10	10		
		2-Hexanone	<10	10		
		Acrolein	<10	10		
		Acrylonitrile	<10	10		
		Methyltertiary Butyl Ether	<1.0	1.0		
		Iodomethane	<1.0	1.0		
	Surrogate Recoveries					
		1,2-Dichloroethane-d4	100		% Recovery	
		Toluene-d8	100			
		4-Bromofluorobenzene	100			

Site	Depth	Lab No.	Methodology	Analysis	Results	Units	Analyzed

QUALITY ASSURANCE DATA

Trip Blank — 8260 LONG — RH:05-21-96

	µg/L	PQL
1,1-Dichloroethene	<1.0	1.0
Methylene Chloride	<1.0	1.0
trans-1,2-Dichloroethene	<1.0	1.0
1,1-Dichloroethane	<1.0	1.0
2,2-Dichloropropane	<1.0	1.0
cis-1,2-Dichloroethene	<1.0	1.0
Bromochloromethane	<1.0	1.0
Chloroform	<1.0	1.0
1,1,1-Trichloroethane	<1.0	1.0
Carbon Tetrachloride	<1.0	1.0
1,1-Dichloropropene	<1.0	1.0
Benzene	<1.0	1.0
1,2-Dichloroethane	<1.0	1.0
Trichloroethene	<1.0	1.0
1,2-Dichloropropane	<1.0	1.0
Dibromomethane	<1.0	1.0
Bromodichloromethane	<1.0	1.0
Trans-1,3-Dichloropropene	<1.0	1.0
Toluene	<1.0	1.0
cis-1,3-Dichloropropene	<1.0	1.0
1,1,2-Trichloroethane	<1.0	1.0
Tetrachloroethene	<1.0	1.0
1,3-Dichloropropane	<1.0	1.0
Dibromochloromethane	<1.0	1.0
1,2-Dibromoethane	<1.0	1.0
Chlorobenzene	<1.0	1.0
1,1,1,2-Tetrachloroethane	<1.0	1.0
Ethylbenzene	<1.0	1.0
M+P Xylenes	<1.0	1.0
O-Xylene	<1.0	1.0
Styrene	<1.0	1.0
Bromoform	<1.0	1.0
Isopropylbenzene	<1.0	1.0
Bromobenzene	<1.0	1.0
1,1,2,2-Tetrachloroethane	<1.0	1.0
1,2,3-Trichloropropane	<1.0	1.0
n-Propylbenzene	<1.0	1.0
2-Chlorotoluene	<1.0	1.0
4-Chlorotoluene	<1.0	1.0
1,3,5-Trimethylbenzene	<1.0	1.0
tert-Butylbenzene	<1.0	1.0
1,2,4-Trimethylbenzene	<1.0	1.0
sec-Butylbenzene	<1.0	1.0
1,3-Dichlorobenzene	<1.0	1.0
1,4-Dichlorobenzene	<1.0	1.0
p-Isopropyltoluene	<1.0	1.0
1,2-Dichlorobenzene	<1.0	1.0
n-Butylbenzene	<1.0	1.0
1,2-Dibromo-3-Chloropropane	<1.0	1.0
1,2,4-Trichlorobenzene	<1.0	1.0
Naphthalene	<1.0	1.0
Hexachlorobutadiene	<1.0	1.0
1,2,3-Trichlorobenzene	<1.0	1.0
Acetone	<20	20
Methyl Ethyl Ketone	<10	10
Dichlorodifluoromethane	<1.0	1.0
Chloromethane	<1.0	1.0
Vinyl Chloride	<1.0	1.0
Bromomethane	<1.0	1.0
Chloroethane	<1.0	1.0
Trichlorofluoromethane	<1.0	1.0
2-Chloroethylvinylether	<1.0	1.0
Carbon Disulfide	<1.0	1.0
Vinyl Acetate	<1.0	1.0
Methyl Isobutyl Ketone	<10	10
2-Hexanone	<10	10
Acrolein	<10	10
Acrylonitrile	<10	10
Methyltertiary Butyl Ether	<1.0	1.0
Iodomethane	<1.0	1.0

Surrogate Recoveries

1,2-Dichloroethane-d4	99	% Recovery
Toluene-d8	103	
4-Bromofluorobenzene	101	

ENERGY LABORATORIES, INC.
P.O. Box 2470 610 Farnwood Street voice 605-342-1225
Rapid City, SD 57709 fax 605-342-1397

CHAIN OF CUSTODY RECORD

PLEASE PRINT OR TYPE ALL INFORMATION EXCEPT SIGNATURES

P.O. # | Project Name / Address: ELLSWORTH AFB, RADIAN, PRIDE HANGAR

Contact Name & Phone: JAMES MACHIN

Sampler's signature:

Invoice to:

Report to:

DATE	TIME	composite	grab sample	SAMPLE I.D.	number of containers	Sample Type: A Air W Water S Soils/solids V Vegetation U Urine O Other	Analysis Requested: B260							Comments, Special Instructions, etc.
5/16/96	0700			EFFLUENT DISCHARGE # 6	1	W	✓							
5/16/96	0945			~~Pre Test~~ Jim EW-1 Post Test	3	W	✓							
5/16/96	0950			EW-1D Post Test	3	W	✓							
5/16/96	1700			EW-2 Pre Test	3	W	✓							Rush
				Trip Blanks	2									

1. Relinquished (signature)	Date	Time	Received by: (signature)	3. Relinquished (signature)	Date	Time	Received by (signature):
	5/17/96	8:15					
2. Relinquished (signature)	**Date**	**Time**	**Received by: (signature)**	**4. Relinquished (signature)**	**Date**	**Time**	**Received for laboratory by (signature):**
					5/17/96	8:15	Marcie Sprague

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ENERGY LABORATORIES, INC.
P.O. Box 2470 610 Farnwood Street voice 605-342-1225
Rapid City, SD 57709 fax 605-342-1397

CHAIN OF CUSTODY RECORD

PLEASE PRINT OR TYPE ALL INFORMATION EXCEPT SIGNATURES

P.O. #

Project Name / Address: Radian - Ellsworth AFB BG-04

Contact Name & Phone: James Mochin

Sampler's signature:

Invoice to:

Report to:

DATE	TIME	composite	grab sample	SAMPLE I.D.	number of containers	Sample Type: A Air W Water S Soils/solids V Vegetation U Urine O Other	Analysis Requested: 8260	Comments, Special Instructions, etc.
5/19/96	1643			BG-04 Effluent #1	3	W	X	
5/19/96	1812			BG-04 EFFLUENT #2	3	W	✓	
5/20/96	0735			BG-04 EFFLUENT #3	3	W	✓	
5/20/96				TRIP BLANKS	2	W		

1. Relinquished (signature)	Date	Time	Received by: (signature)	3. Relinquished (signature)	Date	Time	Received by (signature):
William O'Sullivan	5/20/96	1300					
2. Relinquished (signature)	**Date**	**Time**	**Received by: (signature)**	**4. Relinquished (signature)**	**Date**	**Time**	**Received for laboratory by (signature):**
					5/20/96	1:10	Sandy Lee Jack

C-36

ENERGY LABORATORIES, INC.
P.O. Box 2470 610 Farnwood Street voice 605-342-1225
Rapid City, SD 57709 fax 605-342-1397

CHAIN OF CUSTODY RECORD

PLEASE PRINT OR TYPE ALL INFORMATION EXCEPT SIGNATURES

P.O. # | Project Name / Address: ELLSWORTH AFB RADIAN BG-OA

Contact Name & Phone: JAMES MACHIN 512 419 5280

Sampler's signature:

Invoice to:

Report to:

DATE	TIME	composite	grab sample	SAMPLE I.D.	number of containers	Sample Type: A Air W Water S Soils/solids V Vegetation U Urine O Other	Analysis Requested: 8260	Comments, Special Instructions, etc.
5/20/96	1450			BG-OA EFFLUENT #4	3	W	✓	
5/21/96	0815			BG-OA EFFLUENT #5	3	W	✓	
5/21/96	1545			BG-OA EFFLUENT #6	3	W	✓	
5/22/96	1000			BG-OA EFFLUENT #7	3	W	✓	
5/22/96	1000			BG-OA EFFLUENT DUPLICATE #7	3	W	✓	
5/22/96	1600			BG-OA EFFLUENT DISCHARGE #8	3	W	✓	
				TRIP BLANKS	2	W		

1. Relinquished (signature)	Date	Time	Received by: (signature)	3. Relinquished (signature)	Date	Time	Received by (signature):
William A Bullins	5/23/96	0815					
2. Relinquished (signature)	**Date**	**Time**	**Received by: (signature)**	**4. Relinquished (signature)**	**Date**	**Time**	**Received for laboratory by (signature):**
					5/23/96	8:15	Marcie Sprague

C-37

ENERGY LABORATORIES, INC.
P.O. Box 2470 610 Farnwood Street voice 605-342-1225
Rapid City, SD 57709 fax 605-342-1397

CHAIN OF CUSTODY RECORD

PLEASE PRINT OR TYPE ALL INFORMATION EXCEPT SIGNATURES

P.O. #

Project Name / Address: ELLSWORTH AFB RADIAN BG-04

Contact Name & Phone: JAMES MACHIN 512-419-5280

Sampler's signature: Bill Bullard

Invoice to:

Report to:

DATE	TIME	composite	grab sample	SAMPLE I.D.	number of containers	Sample Type: A Air W Water S Soils/solids V Vegetation U Urine O Other	Analysis Requested: 8260	Comments, Special Instructions, etc.
5/23/96	0920			BG-04 EFFLUENT #9	3	W	✓	
5/23/96	1615			BG-04 EFFLUENT #10	3	W	✓	
5/24/96	1045			BG-04 EFFLUENT #11	3	W	✓	
5/24/96				TRIP BLANKS	2			

1. Relinquished (signature)	Date	Time	Received by: (signature)	3. Relinquished (signature)	Date	Time	Received by (signature):
Bill Bullard	5/24/96	11:20AM					
2. Relinquished (signature)	**Date**	**Time**	**Received by: (signature)**	**4. Relinquished (signature)**	**Date**	**Time**	**Received for laboratory by (signature):**
					5/24/96	11:20	Marcie Sprague

C-38

ENERGY LABORATORIES, INC.
P.O. Box 2470 610 Farnwood Street voice 605-342-1225
Rapid City, SD 57709 fax 605-342-1397

CHAIN OF CUSTODY RECORD

PLEASE PRINT OR TYPE ALL INFORMATION EXCEPT SIGNATURES

P.O. # | Project Name / Address: RADIAN, ELLSWORTH AFB

Contact Name & Phone: JAMES MACHIN 512 419 5280 | Sampler's signature: Bill Bullard

Invoice to:

Report to:

DATE	TIME	composite	grab sample	SAMPLE I.D.	number of containers	Sample Type: A W S V U O (Air Water Soils/solids Vegetation Urine Other)	Analysis Requested: 8260	Comments, Special Instructions, etc.
5/24/96	1545			BG-04 EFFLUENT # 12	3	W	✓	1 VIAL BROKEN
5/25/96	1010			BG-04 EFFLUENT # 13	3	W	✓	
5/25/96	1110			FW-2 POST TEST	3	W	✓	

	Relinquished (signature)	Date	Time	Received by: (signature)
1.	Bill Bullard	5/25/96	1730 PM	
2.				

	Relinquished (signature)	Date	Time	Received by (signature):
3.				
4.				Received for laboratory by (signature):

APPENDIX D

Vapor Sample Analytical Data

MICROSEEPS

University of Pittsburgh Applied Research Center
220 William Pitt Way, Pittsburgh, PA 15238
(412) 826-5245
FAX (412) 826-3433

June 3, 1996

Mr. Bill Buchans
Radian International
1093 Commerce Park Drive
Oak Ridge, TN 37830

Dear Mr. Buchans:

Attached is the final data listing for the samples we received on May 28, 1996, from James Machin, project #612-001-31-30.

Please give me call if you have questions or I can be of further assistance. Thank you for using MICROSEEPS.

Sincerely,

David J. Masdea

DJM/lsp

Attachment: RAD75-962430

MICROSEEPS

ANALYSIS OF VOLATILE ORGANICS IN GAS SAMPLES

Gas samples are received and secured in accordance with Microseeps documented sample receipt procedures. Analyses are performed using Microseeps Analytical Method AM4.03. Analytical method AM4.03 is a modification of USEPA Method 3810 (Headspace) and 8000 (Gas Chromatography). Modifications implemented are to accommodate the gas phase sample type only. All applicable quality control procedures are followed including continuing calibration check standards and laboratory blanks. Microseeps Analytical Method AM4.03 will be supplied upon request.

220 William Pitt Way, Pittsburgh, PA 15238 • Phone (412) 826-5245, Fax (412) 826-3433

MICROSEEPS

RAD75-962430

----- RADIAN INTERNATIONAL ----
----- PROJECT LOC: ELLSWORTH AFB -----
----- PROJECT NO: 612-001-31-30 -----
----- 601/602 SCAN -----
----- CONCENTRATIONS IN PPMV -----

	SAMPLE ID	SAMPLE ID	SAMPLE ID	SAMPLE ID	
COMPOUND NAME	BG-04 V-1	BG-04 V-2	BG-04 V-3	BG-04 V-4	LDLs
CHLOROMETHANE	<1	<1	<1	<1	1
VINYL CHLORIDE	<1	<1	<1	<1	1
BROMOMETHANE/CHLOROETHANE*	<1	<1	<1	<1	1
FLUOROTRICHLOROMETHANE	<.005	<.005	<.005	<.005	0.005
1,1 DICHLOROETHYLENE	<.01	<.01	<.01	<.01	0.01
METHYLENE CHLORIDE	<1	<1	<1	<1	1
TRANS-1,2 DICHLOROETHYLENE	<.1	<.1	<.1	<.1	0.1
1,1 DICHLOROETHANE	<.01	<.01	<.01	<.01	0.01
CHLOROFORM	<.005	<.005	<.005	<.005	0.005
1,1,1 TRICHLOROETHANE	<.005	<.005	<.005	<.005	0.005
CARBON TETRACHLORIDE	<.005	<.005	<.005	<.005	0.005
BENZENE	<.07	<.07	<.07	<.07	0.07
1,2 DICHLOROETHANE	<.01	<.01	<.01	<.01	0.01
TRICHLOROETHYLENE	0.366	0.315	0.221	0.492	0.005
1,2 DICHLOROPROPANE	<.01	<.01	<.01	<.01	0.01
BROMODICHLOROMETHANE	<.005	<.005	<.005	<.005	0.005
CIS-1,3 DICHLOROPROPYLENE	<.01	<.01	<.01	<.01	0.01
TOLUENE	<.07	<.07	<.07	<.07	0.07
TRANS-1,3 DICHLOROPROPYLENE	<.01	<.01	<.01	<.01	0.01
1,1,2 TRICHLOROETHANE	<.005	<.005	<.005	<.005	0.005
TETRACHLOROETHYLENE	<.005	<.005	<.005	<.005	0.005
CHLORODIBROMOMETHANE	<.005	<.005	<.005	<.005	0.005
CHLOROBENZENE	<.07	<.07	<.07	<.07	0.07
ETHYL BENZENE	<.07	<.07	<.07	<.07	0.07
BROMOFORM	<.005	<.005	<.005	<.005	0.005
1,1,2,2 TETRACHLOROETHANE	<.005	<.005	<.005	<.005	0.005
1,3 DICHLOROBENZENE	<.07	<.07	<.07	<.07	0.07
1,4 DICHLOROBENZENE	<.07	<.07	<.07	<.07	0.07
1,2 DICHLOROBENZENE	<.07	<.07	<.07	<.07	0.07
ADDITIONAL ANALYSIS					
CIS-1,2 DICHLOROETHYLENE	<.01	<.01	<.01	<.01	0.01
FILE NAME	W62 379	W62 380	W62 381	W62 382	
DATE SAMPLED	05/19/96	05/19/96	05/20/96	05/20/96	
DATE RECEIVED	05/28/96	05/28/96	05/28/96	05/28/96	
DATE ANALYZED	05/28/96	05/28/96	05/28/96	05/28/96	

* COMPOUNDS ELUTE TOGETHER ON ECD: VALUES REPRESENT EITHER OR A COMBINATION OF BOTH.

29-May-96

ANALYST INITIALS

LAB MANAGER INITIALS DOM

MICROSEEPS

RAD75-962430

----- RADIAN INTERNATIONAL ----
----- PROJECT LOC: ELLSWORTH AFB -----
----- PROJECT NO: 612-001-31-30 -----
----- 601/602 SCAN -----
----- CONCENTRATIONS IN PPMV -----

	SAMPLE ID	SAMPLE ID	SAMPLE ID	SAMPLE ID	
COMPOUND NAME	BG-04 V-5	BG-04 V-6	BG-04 V-7	BG-04 V-7D	LDLs
CHLOROMETHANE	<1	<1	<1	<1	1
VINYL CHLORIDE	<1	<1	<1	<1	1
BROMOMETHANE/CHLOROETHANE*	<1	<1	<1	<1	1
FLUOROTRICHLOROMETHANE	<.005	<.005	<.005	<.005	0.005
1,1 DICHLOROETHYLENE	<.01	<.01	<.01	<.01	0.01
METHYLENE CHLORIDE	<1	<1	<1	<1	1
TRANS-1,2 DICHLOROETHYLENE	<.1	<.1	<.1	<.1	0.1
1,1 DICHLOROETHANE	<.01	<.01	<.01	<.01	0.01
CHLOROFORM	<.005	<.005	<.005	<.005	0.005
1,1,1 TRICHLOROETHANE	<.005	<.005	<.005	<.005	0.005
CARBON TETRACHLORIDE	<.005	<.005	<.005	<.005	0.005
BENZENE	<.07	<.07	<.07	<.07	0.07
1,2 DICHLOROETHANE	<.01	<.01	<.01	<.01	0.01
TRICHLOROETHYLENE	0.267	0.400	0.386	0.306	0.005
1,2 DICHLOROPROPANE	<.01	<.01	<.01	<.01	0.01
BROMODICHLOROMETHANE	<.005	<.005	<.005	<.005	0.005
CIS-1,3 DICHLOROPROPYLENE	<.01	<.01	<.01	<.01	0.01
TOLUENE	<.07	<.07	<.07	<.07	0.07
TRANS-1,3 DICHLOROPROPYLENE	<.01	<.01	<.01	<.01	0.01
1,1,2 TRICHLOROETHANE	<.005	<.005	<.005	<.005	0.005
TETRACHLOROETHYLENE	<.005	<.005	<.005	<.005	0.005
CHLORODIBROMOMETHANE	<.005	<.005	<.005	<.005	0.005
CHLOROBENZENE	<.07	<.07	<.07	<.07	0.07
ETHYL BENZENE	<.07	<.07	<.07	<.07	0.07
BROMOFORM	<.005	<.005	<.005	<.005	0.005
1,1,2,2 TETRACHLOROETHANE	<.005	<.005	<.005	<.005	0.005
1,3 DICHLOROBENZENE	<.07	<.07	<.07	<.07	0.07
1,4 DICHLOROBENZENE	<.07	<.07	<.07	<.07	0.07
1,2 DICHLOROBENZENE	<.07	<.07	<.07	<.07	0.07
ADDITIONAL ANALYSIS					
CIS-1,2 DICHLOROETHYLENE	<.01	<.01	<.01	<.01	0.01
FILE NAME	W62 383	W62 384	W62 385	W62 386	
DATE SAMPLED	05/21/96	05/21/96	05/22/96	05/22/96	
DATE RECEIVED	05/28/96	05/28/96	05/28/96	05/28/96	
DATE ANALYZED	05/28/96	05/29/96	05/29/96	05/29/96	

* COMPOUNDS ELUTE TOGETHER ON ECD: VALUES REPRESENT EITHER OR A COMBINATION OF BOTH.

29-May-96

ANALYST INITIALS

LAB MANAGER INITIALS

MICROSEEPS

RAD75-962430

----- RADIAN INTERNATIONAL ----
----- PROJECT LOC: ELLSWORTH AFB -----
----- PROJECT NO: 612-001-31-30 -----
----- 601/602 SCAN -----
----- CONCENTRATIONS IN PPMV -----

COMPOUND NAME	SAMPLE ID BG-04 V-8	SAMPLE ID BG-04 V-9	LDLs
CHLOROMETHANE	<1	<1	1
VINYL CHLORIDE	<1	<1	1
BROMOMETHANE/CHLOROETHANE*	<1	<1	1
FLUOROTRICHLOROMETHANE	<.005	<.005	0.005
1,1 DICHLOROETHYLENE	<.01	<.01	0.01
METHYLENE CHLORIDE	<1	<1	1
TRANS-1,2 DICHLOROETHYLENE	<.1	<.1	0.1
1,1 DICHLOROETHANE	<.01	<.01	0.01
CHLOROFORM	<.005	<.005	0.005
1,1,1 TRICHLOROETHANE	<.005	<.005	0.005
CARBON TETRACHLORIDE	<.005	<.005	0.005
BENZENE	<.07	<.07	0.07
1,2 DICHLOROETHANE	<.01	<.01	0.01
TRICHLOROETHYLENE	0.205	0.201	0.005
1,2 DICHLOROPROPANE	<.01	<.01	0.01
BROMODICHLOROMETHANE	<.005	<.005	0.005
CIS-1,3 DICHLOROPROPYLENE	<.01	<.01	0.01
TOLUENE	<.07	<.07	0.07
TRANS-1,3 DICHLOROPROPYLENE	<.01	<.01	0.01
1,1,2 TRICHLOROETHANE	<.005	<.005	0.005
TETRACHLOROETHYLENE	<.005	<.005	0.005
CHLORODIBROMOMETHANE	<.005	<.005	0.005
CHLOROBENZENE	<.07	<.07	0.07
ETHYL BENZENE	<.07	<.07	0.07
BROMOFORM	<.005	<.005	0.005
1,1,2,2 TETRACHLOROETHANE	<.005	<.005	0.005
1,3 DICHLOROBENZENE	<.07	<.07	0.07
1,4 DICHLOROBENZENE	<.07	<.07	0.07
1,2 DICHLOROBENZENE	<.07	<.07	0.07
ADDITIONAL ANALYSIS			
CIS-1,2 DICHLOROETHYLENE	<.01	<.01	0.01
FILE NAME	W62 387	W62 388	
DATE SAMPLED	05/22/96	05/23/96	
DATE RECEIVED	05/28/96	05/28/96	
DATE ANALYZED	05/29/96	05/29/96	

* COMPOUNDS ELUTE TOGETHER ON ECD: VALUES REPRESENT EITHER OR A COMBINATION OF BOTH.

29-May-96

ANALYST INITIALS

LAB MANAGER INITIALS DOM

MICROSEEPS

RAD75-962430

**** QUALITY CONTROL ****
----- RADIAN INTERNATIONAL ----
----- PROJECT LOC: ELLSWORTH AFB -----
----- PROJECT NO: 612-001-31-30 -----
----- 601/602 SCAN -----
----- CONCENTRATIONS IN PPMV -----

CONTINUING CALIBRATION CHECK

STANDARDS: "624"(LEVEL 2), "624"(LEVEL 1), "VC-996", "CIS"
REFERENCE: W62A/B376, W62A/B377, W62A378, W628391

COMPOUND	KNOWN	RESULT	PERCENT DIFFERENCE
CHLOROMETHANE	20.8	21.9	5.52
VINYL CHLORIDE	996.0	963.1	3.31
BROMOMETHANE/CHLOROETHANE*	2.7	3.0	12.74
FLUOROTRICHLOROMETHANE	0.765	0.822	7.45
1,1 DICHLOROETHYLENE	1.09	1.21	11.71
METHYLENE CHLORIDE	1.24	1.39	12.36
TRANS-1,2 DICHLOROETHYLENE	1.09	1.22	11.98
1,1 DICHLOROETHANE	1.06	1.17	9.78
CHLOROFORM	0.881	0.959	8.85
1,1,1 TRICHLOROETHANE	0.788	0.855	8.50
CARBON TETRACHLORIDE	0.684	0.728	6.43
BENZENE & 1,2-DCA**	2.41	2.39	0.95
1,2 DICHLOROETHANE	1.06	1.17	9.69
TRICHLOROETHYLENE	0.800	0.876	9.50
1,2 DICHLOROPROPANE	0.93	1.00	7.63
BROMODICHLOROMETHANE	0.642	0.708	10.28
CIS-1,3 DICHLOROPROPYLENE	0.95	1.05	11.18
TOLUENE	1.14	1.13	1.31
TRANS-1,3 DICHLOROPROPYLENE	0.95	1.05	10.55
1,1,2 TRICHLOROETHANE	0.788	0.885	12.31
TETRACHLOROETHYLENE	0.634	0.684	7.89
CHLORODIBROMOMETHANE	0.505	0.560	10.89
CHLOROBENZENE	0.93	0.94	0.86
ETHYL BENZENE	0.99	0.99	0.10
BROMOFORM	0.416	0.468	12.50
1,1,2,2 TETRACHLOROETHANE	0.626	0.696	11.18
1,3 DICHLOROBENZENE	0.72	0.66	8.25
1,4 DICHLOROBENZENE	0.72	0.64	11.05
1,2 DICHLOROBENZENE	0.72	0.63	12.17
CIS-1,2 DICHLOROETHYLENE	27.20	28.90	6.24

* COMPOUNDS ELUTE TOGETHER ON ECD: VALUES REPRESENT EITHER OR A COMBINATION OF BOTH.
** COMPOUNDS ELUTE TOGETHER ON FID - VALUE REPRESENTS A COMBINATION OF BOTH.

29-May-96

ANALYST INITIALS

LAB MANAGER INITIALS

MICROSEEPS

RAD75-962430

**** QUALITY CONTROL ****
----- RADIAN INTERNATIONAL ----
----- PROJECT LOC: ELLSWORTH AFB -----
----- PROJECT NO: 612-001-31-30 -----
----- 601/602 SCAN -----
----- CONCENTRATIONS IN PPMV -----

LABORATORY BLANK RESULTS

BLANK: N2 IN VIAL
REFERENCE: W62A/B375

COMPOUND	BLANK	LOWER DETECTION LIMIT
CHLOROMETHANE	ND	1.0
VINYL CHLORIDE	ND	1.0
BROMOMETHANE/CHLOROETHANE*	ND	1.0
FLUOROTRICHLOROMETHANE	ND	0.005
1,1 DICHLOROETHYLENE	ND	0.01
METHYLENE CHLORIDE	ND	1.00
TRANS-1,2 DICHLOROETHYLENE	ND	0.10
1,1 DICHLOROETHANE	ND	0.01
CHLOROFORM	ND	0.005
1,1,1 TRICHLOROETHANE	ND	0.005
CARBON TETRACHLORIDE	ND	0.005
BENZENE	ND	0.07
1,2 DICHLOROETHANE	ND	0.01
TRICHLOROETHYLENE	ND	0.005
1,2 DICHLOROPROPANE	ND	0.01
BROMODICHLOROMETHANE	ND	0.005
CIS-1,3 DICHLOROPROPYLENE	ND	0.01
TOLUENE	ND	0.07
TRANS-1,3 DICHLOROPROPYLENE	ND	0.01
1,1,2 TRICHLOROETHANE	ND	0.005
TETRACHLOROETHYLENE	ND	0.005
CHLORODIBROMOMETHANE	ND	0.005
CHLOROBENZENE	ND	0.07
ETHYL BENZENE	ND	0.07
BROMOFORM	ND	0.005
1,1,2,2 TETRACHLOROETHANE	ND	0.005
1,3 DICHLOROBENZENE	ND	0.07
1,4 DICHLOROBENZENE	ND	0.07
1,2 DICHLOROBENZENE	ND	0.07
CIS-1,2 DICHLOROETHYLENE	ND	0.01

* COMPOUNDS ELUTE TOGETHER ON ECD - VALUES REPRESENT EITHER OR A COMBINATION OF BOTH.

29-May-96

ANALYST INITIALS: JH

LAB MANAGER INITIALS DTM

MICROSEEPS, Inc.

220 William Pitt Way, Pittsburgh, PA 15238

Phone: (412) 826-5245 Fax: (412) 826-3433

CHAIN-OF-CUSTODY RECORD

Company Name: RADIAN INTERNATIONAL

Address: P.O.BOX 201088 AUSTIN TX 78720

Proj. Manager: JAMES MACHIN / BILL BUCHANS

Proj. Location: ELLSWORTH AFB SOUTH DAKOTA

Proj. Number: 612 001 31 30

Phone # : 512/419-5280 Fax # : 512/454 8807

Sampler's signature : Bill Buchanan

Note: Enter proper letters in Requested Analyses columns below.

Analysis Options

Note: If analysis D,E,or K is selected, scratch (option) NOT wanted.

* A	C1 -C4	G	Chlorinated HC
* B	Hydrogen & Helium	H	BTEX
* C	Permanent Gases (CH4, CO, CO2, N2, O2)	J	BTEX & C5 - C10
D	Mercury (Soil) or (Air **)	K	TPH (C5 - C10) or (C4 -C12)
E	TO-14 by GC/MS (Ambient) or (Source **)	L	C11 - C18
F	601 & 602 Compounds	Other	Specify below.

* An additional 22 ml vial of sample is required when requested in combination with another analysis.

** Available upon request.

Collection Date	Collection Time	Number of Containers	"Summa" # if Can. used	Sample Type	Sample Identification	Requested Analyses					(Other)	Remarks
5/19/96	1440	2		VIALS	BG-04 V-1	F					cis-1,2 DCE	AM 4.03
5/19/96	1815	2		VIALS	BG-04 V-2	F					cis-1,2 DCE	AM 4.03
5/20/96	0740	2		VIALS	BG-04 V-3	F					cis-1,2 DCE	AM 4.03
5/20/96	1450	2		VIALS	BG-04 V-4	F					cis-1,2 DCE	AM 4.03
5/21/96	0815	2		VIALS	BG-04 V-5	F					cis-1,2 DCE	AM 4.03
5/21/96	1545	2		VIALS	BG-04 V-6	F					cis-1,2 DCE	AM 4.03
5/22/96	1000	2		VIALS	BG-04 V-7	F					cis-1,2 DCE	AM 4.03
5/22/96	1000	2		VIALS	BG-04 V-7D	F					cis-1,2 DCE	AM 4.03
5/22/96	1600	2		VIALS	BG-04 V-8	F					cis-1,2 DCE	AM 4.03
5/23/96		2		VIALS	BG-04 V-9	F					cis-1,2 DCE	AM 4.03

Results to : JAMES MACHIN, RADIAN P.O. BOX 201088 AUSTIN TX 78720 / BILL BUCHANS, RADIAN 1093 COMMERCE PARK DR OAK RIDGE TN 37830

Invoice to : JAMES MACHIN, RADIAN P.O. BOX 201088 AUSTIN TX 78720

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Bill Buchanan	RADIAN	23MAY96	1300 PM		MICROSEEPS	5/28/96	10 30 AM
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Laboratory to return. YELLOW COPY : Laboratory PINK COPY : Submitter

D-8

MICROSEEPS

University of Pittsburgh Applied Research Center
220 William Pitt Way, Pittsburgh, PA 15238
(412) 826-5245
FAX (412) 826-3433

June 3, 1996

Mr. Bill Buchans
Radian International
1093 Commerce Park Drive
Oak Ridge, TN 37830

Dear Mr. Buchans:

Attached is the final data listing for the samples we received on May 29, 1996, from James Machin, project #612-001-31-30.

Please give me call if you have questions or I can be of further assistance. Thank you for using MICROSEEPS.

Sincerely,

David J. Masdea

DJM/lsp

Attachment: RAD77-962436

MICROSEEPS

ANALYSIS OF VOLATILE ORGANICS IN GAS SAMPLES

Gas samples are received and secured in accordance with Microseeps documented sample receipt procedures. Analyses are performed using Microseeps Analytical Method AM4.03. Analytical method AM4.03 is a modification of USEPA Method 3810 (Headspace) and 8000 (Gas Chromatography). Modifications implemented are to accommodate the gas phase sample type only. All applicable quality control procedures are followed including continuing calibration check standards and laboratory blanks. Microseeps Analytical Method AM4.03 will be supplied upon request.

220 William Pitt Way, Pittsburgh, PA 15238 • Phone (412) 826-5245, Fax (412) 826-3433

MICROSEEPS

RAD77-962436

----- RADIAN INTERNATIONAL ----
----- PROJECT LOC: ELLSWORTH AFB/BG-04 -----
----- PROJECT NO: 612-001-31-30 -----
----- 601/602 SCAN -----
----- CONCENTRATIONS IN PPMV -----

	SAMPLE ID	SAMPLE ID	SAMPLE ID	SAMPLE ID	
COMPOUND NAME	BG-04 V-10	BG-04 V-11	BG-04 V-12	BG-04 V-13	LDLs
CHLOROMETHANE	<1	<1	<1	<1	1
VINYL CHLORIDE	<1	<1	<1	<1	1
BROMOMETHANE/CHLOROETHANE*	<1	<1	<1	<1	1
FLUOROTRICHLOROMETHANE	<.005	<.005	<.005	<.005	0.005
1,1 DICHLOROETHYLENE	<.01	<.01	<.01	<.01	0.01
METHYLENE CHLORIDE	<1	<1	<1	<1	1
TRANS-1,2 DICHLOROETHYLENE	<.1	<.1	<.1	<.1	0.1
1,1 DICHLOROETHANE	<.01	<.01	<.01	<.01	0.01
CHLOROFORM	<.005	<.005	<.005	<.005	0.005
1,1,1 TRICHLOROETHANE	<.005	<.005	<.005	<.005	0.005
CARBON TETRACHLORIDE	<.005	<.005	<.005	<.005	0.005
BENZENE	<.07	<.07	<.07	<.07	0.07
1,2 DICHLOROETHANE	<.01	<.01	<.01	<.01	0.01
TRICHLOROETHYLENE	0.171	0.202	0.257	0.160	0.005
1,2 DICHLOROPROPANE	<.01	<.01	<.01	<.01	0.01
BROMODICHLOROMETHANE	<.005	<.005	<.005	<.005	0.005
CIS-1,3 DICHLOROPROPYLENE	<.01	<.01	<.01	<.01	0.01
TOLUENE	<.07	<.07	<.07	<.07	0.07
TRANS-1,3 DICHLOROPROPYLENE	<.01	<.01	<.01	<.01	0.01
1,1,2 TRICHLOROETHANE	<.005	<.005	<.005	<.005	0.005
TETRACHLOROETHYLENE	<.005	<.005	<.005	<.005	0.005
CHLORODIBROMOMETHANE	<.005	<.005	<.005	<.005	0.005
CHLOROBENZENE	<.07	<.07	<.07	<.07	0.07
ETHYL BENZENE	<.07	<.07	<.07	<.07	0.07
BROMOFORM	<.005	<.005	<.005	<.005	0.005
1,1,2,2 TETRACHLOROETHANE	<.005	<.005	<.005	<.005	0.005
1,3 DICHLOROBENZENE	<.07	<.07	<.07	<.07	0.07
1,4 DICHLOROBENZENE	<.07	<.07	<.07	<.07	0.07
1,2 DICHLOROBENZENE	<.07	<.07	<.07	<.07	0.07
ADDITIONAL ANALYSIS					
CIS-1,2 DICHLOROETHYLENE	<.01	<.01	<.01	<.01	0.01
FILE NAME	W62 424	W62 425	W62 426	W62 427	
DATE SAMPLED	05/23/96	05/24/96	05/24/96	05/25/96	
DATE RECEIVED	05/29/96	05/29/96	05/29/96	05/29/96	
DATE ANALYZED	05/30/96	05/30/96	05/31/96	05/31/96	

* COMPOUNDS ELUTE TOGETHER ON ECD: VALUES REPRESENT EITHER OR A COMBINATION OF BOTH.

31-May-96

ANALYST INITIALS

LAB MANAGER INITIALS

MICROSEEPS

RAD77-962436

**** QUALITY CONTROL ****
----- RADIAN INTERNATIONAL ----
----- PROJECT LOC: ELLSWORTH AFB/BG-04 -----
----- PROJECT NO: 612-001-31-30 -----
----- 601/602 SCAN -----
----- CONCENTRATIONS IN PPMV -----

CONTINUING CALIBRATION CHECK

STANDARDS: "624"(LEVEL 2), "624"(LEVEL 1), "VC-996", "CIS"
REFERENCE: W62A/B421, W62A/B422, W62A423, W62B435

COMPOUND	KNOWN	RESULT	PERCENT DIFFERENCE
CHLOROMETHANE	20.8	22.6	8.43
VINYL CHLORIDE	996.0	985.6	1.04
BROMOMETHANE/CHLOROETHANE*	27.4	28.1	2.62
FLUOROTRICHLOROMETHANE	0.765	0.881	15.16
1,1 DICHLOROETHYLENE	10.85	10.58	2.50
METHYLENE CHLORIDE	12.4	12.6	1.78
TRANS-1,2 DICHLOROETHYLENE	10.9	11.3	4.17
1,1 DICHLOROETHANE	10.63	11.14	4.77
CHLOROFORM	8.811	9.170	4.07
1,1,1 TRICHLOROETHANE	7.884	8.301	5.29
CARBON TETRACHLORIDE	0.684	0.778	13.74
BENZENE & 1,2-DCA**	2.41	2.59	7.26
1,2 DICHLOROETHANE	10.63	11.14	4.80
TRICHLOROETHYLENE	8.006	8.342	4.20
1,2 DICHLOROPROPANE	9.31	9.79	5.17
BROMODICHLOROMETHANE	6.420	6.608	2.93
CIS-1,3 DICHLOROPROPYLENE	9.48	9.99	5.41
TOLUENE	1.14	1.19	3.94
TRANS-1,3 DICHLOROPROPYLENE	9.48	10.05	6.07
1,1,2 TRICHLOROETHANE	7.884	8.262	4.79
TETRACHLOROETHYLENE	0.634	0.717	13.09
CHLORODIBROMOMETHANE	5.050	5.178	2.53
CHLOROBENZENE	0.93	1.00	7.49
ETHYL BENZENE	0.99	1.03	3.84
BROMOFORM	4.162	4.376	5.14
1,1,2,2 TETRACHLOROETHANE	6.267	6.992	11.57
1,3 DICHLOROBENZENE	0.72	0.66	8.11
1,4 DICHLOROBENZENE	0.72	0.65	8.81
1,2 DICHLOROBENZENE	0.72	0.68	5.03
CIS-1,2 DICHLOROETHYLENE	27.20	29.20	7.35

* COMPOUNDS ELUTE TOGETHER ON ECD: VALUES REPRESENT EITHER OR A COMBINATION OF BOTH.
** COMPOUNDS ELUTE TOGETHER ON FID - VALUE REPRESENTS A COMBINATION OF BOTH.

31-May-96

ANALYST INITIALS

LAB MANAGER INITIALS

MICROSEEPS

RAD77-962436

**** QUALITY CONTROL ****
----- RADIAN INTERNATIONAL ----
----- PROJECT LOC: ELLSWORTH AFB/BG-04 -----
----- PROJECT NO: 612-001-31-30 -----
----- 601/602 SCAN -----
----- CONCENTRATIONS IN PPMV -----

LABORATORY BLANK RESULTS

BLANK: N2 IN VIAL
REFERENCE: W62A/B420

COMPOUND	BLANK	LOWER DETECTION LIMIT
CHLOROMETHANE	ND	1.0
VINYL CHLORIDE	ND	1.0
BROMOMETHANE/CHLOROETHANE*	ND	1.0
FLUOROTRICHLOROMETHANE	ND	0.005
1,1 DICHLOROETHYLENE	ND	0.01
METHYLENE CHLORIDE	ND	1.00
TRANS-1,2 DICHLOROETHYLENE	ND	0.10
1,1 DICHLOROETHANE	ND	0.01
CHLOROFORM	ND	0.005
1,1,1 TRICHLOROETHANE	ND	0.005
CARBON TETRACHLORIDE	ND	0.005
BENZENE	ND	0.07
1,2 DICHLOROETHANE	ND	0.01
TRICHLOROETHYLENE	ND	0.005
1,2 DICHLOROPROPANE	ND	0.01
BROMODICHLOROMETHANE	ND	0.005
CIS-1,3 DICHLOROPROPYLENE	ND	0.01
TOLUENE	ND	0.07
TRANS-1,3 DICHLOROPROPYLENE	ND	0.01
1,1,2 TRICHLOROETHANE	ND	0.005
TETRACHLOROETHYLENE	ND	0.005
CHLORODIBROMOMETHANE	ND	0.005
CHLOROBENZENE	ND	0.07
ETHYL BENZENE	ND	0.07
BROMOFORM	ND	0.005
1,1,2,2 TETRACHLOROETHANE	ND	0.005
1,3 DICHLOROBENZENE	ND	0.07
1,4 DICHLOROBENZENE	ND	0.07
1,2 DICHLOROBENZENE	ND	0.07
CIS-1,2 DICHLOROETHYLENE	ND	0.01

* COMPOUNDS ELUTE TOGETHER ON ECD - VALUES REPRESENT EITHER OR A COMBINATION OF BOTH.

31-May-96

ANALYST INITIALS

LAB MANAGER INITIALS

MICROSEEPS, Inc.

220 William Pitt Way, Pittsburgh, PA 15238

Phone: (412) 826-5245 Fax: (412) 826-3433

CHAIN-OF-CUSTODY RECORD

Company Name: RADIAN INT

Address: P.O. BOX 102088 AUSTIN TX 78720

Proj. Manager: JAMES MACHIN / BILL BUCHANS

Proj. Location: ELLSWORTH AFB BG-04

Proj. Number: 612001 31 30

Phone # : 5124195280 Fax # :

Sampler's signature : BILL BUCHANS

Note: Enter proper letters in Requested Analyses columns below.

Note: If analysis D,E,or K is selected, scratch (option) NOT wanted.

Analysis Options

* A	C1 -C4	G	Chlorinated HC
* B	Hydrogen & Helium	H	BTEX
* C	Permanent Gases (CH4, CO, CO2, N2, O2)	J	BTEX & C5 - C10
D	Mercury (Soil) or (Air **)	K	TPH (C5 - C10) or (C4 -C12)
E	TO-14 by GC/MS (Ambient) or (Source **)	L	C11 - C18
F	601 & 602 Compounds	Other	Specify below.

* An additional 22 ml vial of sample is required when requested in combination with another analysis.

** Available upon request.

Collection Date	Collection Time	Number of Containers	"Summa" # if Can. used	Sample Type	Sample Identification	Requested Analyses					(Other)	Remarks
5/23/96	1615	2		VIALS	BG-04 V-10	F					Cis-1,2 DCE	AM 4.02
5/24/96	1045	2		VIALS	BG-04 V-11	F					Cis-1,2 DCE	AM 4.02
5/24/96	1545	2		VIALS	BG-04 V-12	F					Cis-1,2 DCE	AM 4.02
5/25/96	1010	2		VIALS	BG-04 V-13	F					Cis-1,2 DCE	AM 4.02

D-14

Results to : JAMES MACHIN, RADIAN INT / BILL BUCHANS, RADIAN
P.O. BOX 102088 AUSTIN TX 78720 / 1093 COMMERCE PARK DR OAK RIDGE TN 37830

Invoice to : JAMES MACHIN RADIAN INT
P.O. BOX 102088
AUSTIN TX 78720

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
BILL BUCHANS	RADIAN	28 MAY 96	0800		MICROSEEPS	5/29/96	1020
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Laboratory to return. YELLOW COPY : Laboratory PINK COPY : Submitter

APPENDIX E

Comparison of TPE vs Pump and Treat

RADIAN CORPORATION

CALCULATION SHEET

CALC. NO. BG-04

SIGNATURE BILL BUCHANS DATE 25 JULY 96 CHECKED JLM DATE 7/25/96

PROJECT PREECA - ELLSWORTH AFB JOB NO. 612 001 31 39

SUBJECT PUMP & TREAT VS TPE SHEET 1 OF 1 SHEETS

COMPARISON OF TPE VERSUS GROUNDWATER PUMP & TREAT

TOTAL GALLONS REMOVED IN TEST = 19,466 GAL WATER.

AVERAGE CONTAMINANT CONCENTRATION IN WATER:

PRE-TEST = 45 Mg/L
POST-TEST = 36 Mg/L FROM EW-2

$(45+36)/2 = 40.5$ Mg/L

MASS CALCULATION:

19,466 GALLONS (8.34 LB/GAL)(40.5 Mg/L TCE)(10^{-9} L/Mg WATER)

= 0.00656 LB TCE

COMPARISON OF MASS REMOVED WITH TPE TO MASS REMOVED WITH P&T:

0.0159/0.00656 = 2.4 TIMES GREATER WITH TPE.